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ABSTRACT

Recommended for grades 7-10 social studies classes, this unit presents information about the history of oil, how fast it is being used, difficulties in transporting it, and oil's effect on the world economy. The unit, consisting of eight daily lesson plans, which may be expanded over several more days, contains activity sheets which allow students to reflect on materials read and to examine how petroleum has played such an important part in our history. Fry readability levels for the readings, process skills fostered, general goals and objectives, planning guide, and evaluation suggestions are provided in the introduction. Rationale, objectives, and instructional strategies are also provided for each activity. A pre-/post-test on the unit is included. (Author/JN)

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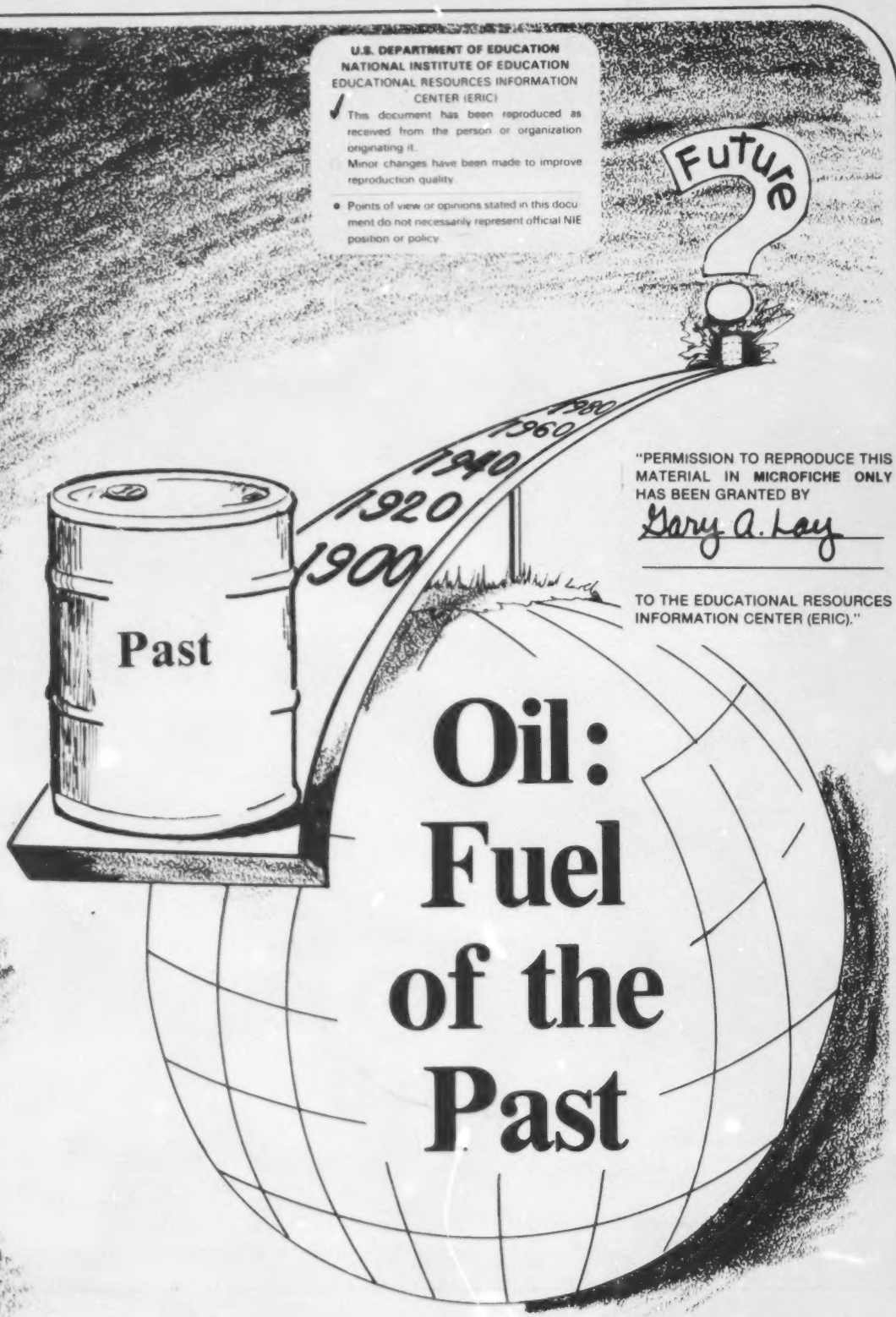

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Oil: Fuel of the Past

A Basic Teaching Unit On Energy

nebraska energy office

Oil! Fuel of the Past

Adapted and Edited

by

Hugh McDermott

Larry Scharmann

Recommended Subject: Social Studies 7-10

TO THE INSTRUCTOR . . .

"Oil! Fuel of the Past" is a unit which presents information about the history of oil, how fast it is being used, difficulties in transporting it, and oil's effect on the world economy.

This unit consists of eight daily lesson plans which may be expanded over several more days depending upon teacher judgment. It contains activity sheets which allow students to reflect on materials read and examine how petroleum has played such an important part in our history.

Since the material sources continue to change periodically, the source, **Energy Info — A Directory of Publications and Audio-Visual Materials From the Nebraska Energy Office,** contains a list of general topics available from the Nebraska Energy Office. You are encouraged to use the ordering page attached to this unit.

Larry Scharmann
Education Coordinator
Nebraska Energy Office
P.O. Box 95085
Lincoln, NE 68509
(402) 471-2867

ACKNOWLEDGEMENTS

The original "Basic Teaching Units on Energy" consisted of a package of 30 instructional packets contained within three volumes. The original fourteen units were written at the University of Nebraska-Lincoln, under the auspices of the Nebraska Energy Office, by Nebraska teachers participating in a three-week Faculty Development Institute sponsored by the U.S. Department of Energy (summer, 1978). The units were edited by the following individuals:

—Dr. Donald McCurdy, Professor of Science Education, University of Nebraska-Lincoln;
—Mr. Gary A. Lay, Education Coordinator, Nebraska Energy Office; and
—Dr. Robert Reeder, Science Department Chairman, East High School, Lincoln, Nebraska.

An additional eight units were written by independent authors in the summer of 1979 and the final eight units were developed as a result of a second federal grant (summer, 1980).

The present format has been achieved as a result of an evaluation conducted by the Nebraska Energy Office, February, 1981. Rather than continue to offer all 30 units as a single package, the Nebraska Energy Office determined to revise, edit, and typeset the 10-12 highest quality units and continue to offer the other units in their present format.

The editors of these revised "Basic Teaching Units" wish to thank the individual writers, original editors, and clerical staff for their contributions in creating the "Basic Teaching Units."

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Oil! Fuel of the Past

Abstract

The first four activities, "The History of Oil," "What is an Energy Gulf," "Super Size," and "The Wreck of the Amoco Cadiz and its Effects on the Environment," focus on the history and location of oil, how oil is transported, and possible problems when oil is spilled. The next two activities, "The Energy Crisis and Developing Nations" and "Petrodollars, The Problem of Too Much Money," contrast the countries that have oil and those that do not. They suggest some special problems for the world economy. "Energy and Doubling Time" illustrates the exponential growth theory of population versus the growth of oil resources. Finally, "The Oil Price Game — Everybody Plays" presents trade dilemmas for members in a competitive market and in a controlled market.

Recommended Level

Grades 7-10

Academic Areas

Social Studies

Readability Ratings (Fry)

The readability reading level given for each reading below is based on the number of syllables per hundred words and number of sentences per passage. These reading level estimations will allow teachers the opportunity to perform some pre-reading exercises on vocabulary and concept development.

"The Early Days of Oil" — 10th year 4th month
"Some Common Misconceptions" — 10th year
"Shoreline Impact of an Oil Spill" — 7th year 4th month
"The Energy Crisis and Developing Nations" — 9th year 9th month
"Petrodollars: The Problem of Too Much Money" — 11th year
"Energy and Doubling Time" — 7th year 5th month

Time Required

8-10 days

Process Skills

—Bartering
—Calculating
—Charting
—Discussing
—Estimating
—Hypothesizing
—Identifying
—Interpreting
—Labeling
—Locating
—Reading

Advanced Teacher Preparation

Obtain: Any films or cassettes applicable.

Read: Energy Info — A Directory of Publications and Audiovisual Materials From the Nebraska Energy Office.

Goals

1. Students will become aware of the depletion rate of petroleum.
2. Students will become aware of the locations of world petroleum reserves.
3. Students will become aware of the transportation problems associated with the distribution of petroleum resources.
4. Students will gain an awareness of the history of petroleum.
5. Students will become aware of petroleum's influence on various nations.
6. Students will be able to identify ecological effects petroleum has on the environment.

Student Objectives

1. Students will be able to identify on a map, the approximate location of 95 percent of the known world oil reserves.
2. Students will be able to identify several ways petroleum can be transported.
3. Students will be able to identify the effects of oil spills on the environment.
4. Students will be able to discuss the role petroleum plays in the world's economy and developing/developed countries.
5. Students will be able to estimate the effect of exponential growth.
6. Students will be able to barter supplies of oil for a market price.

Planning Guide

Day 1

Pre-Test "Energy in the Global Marketplace"
Activity #1 "The History of Oil"

Day 2

Activity #2 "What is an Energy Gulf?"

Day 3

Activity #3 "Super Size"

Day 4

Activity #4 "The Wreck of the Amoco Cadiz and its Effects on the Environment"

Day 5

Activity #5 "The Energy Crisis and Developing Nations"

Day 6

Activity #6 "Petrodollars: The Problem of Too Much Money"

Day 7

Activity #7 "Energy and Doubling Time"

Day 8

Activity #8 "The Oil Price Game — Everybody Plays"
Post Test "Energy in the Global Marketplace"

Evaluation Suggestions

This unit allows teachers to develop their own instruments for evaluation. A Pre-Post test is enclosed for your convenience.

Pre-Test Instructions

Instructor Information. . .

"Energy in the Global Marketplace"

Administer pre-test to determine students' knowledge of unit materials. You should have enough time to begin Activity #1—"The History of Oil"—after giving the pre-test.

The pre-test can also be used "as is" for the post test. This will give you some indication of the success of student performance when compared with their pre-test results. (The teacher's key follows the student copy).

Energy in the Global Marketplace
Pre and Post-Test
Worksheet, Page 1

Name _____

Date _____

Directions:
For test items 1 to 7 write the letter of the best answer.

_____1. What energy supply in the Middle East is one of the world's largest? (a) wood (b) hydroelectric power (c) coal (d) oil.

_____2. Which set of initials stands for a group of oil-producing countries? (a) GNP (b) OPEC (c) NATO (d) USSR.

_____3. Income that oil producing nations get from the sale of oil and then invest in other nation's goods and services is called (a) embargo money (b) GNP (c) petrodollars (d) NATO.

_____4. Economists often talk of supply and demand in energy. Which countries would **demand** oil? (a) oil producing nations (b) oil consuming nations.

_____5. In what unit is oil normally bought and sold? (a) ton (b) barrel (c) KWH (d) Calorie.

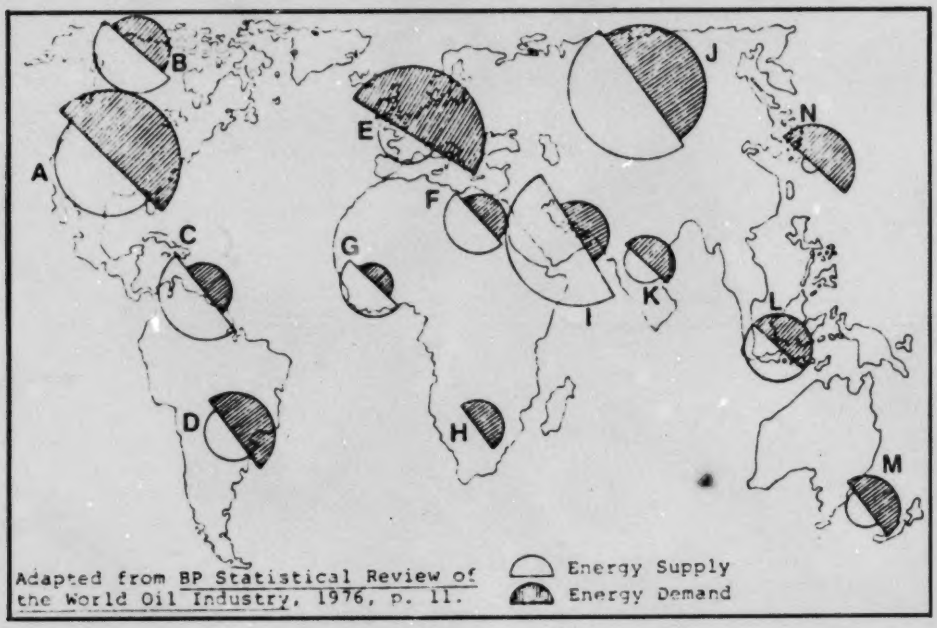
_____6. The price of oil in the world market is (a) determined by free competition (b) controlled by oil producing nations (c) controlled by the United Nations (d) determined by the United States.

_____7. Since 1970, the growth in the world's use of oil has been (a) greater than the population growth (b) less than the population growth (c) about the same as the population growth (d) unrelated to the population growth.

Further Directions:
Test items 8 to 13 refer to the map on the next page.

Name _____

Date _____



Adapted from BP Statistical Review of the World Oil Industry, 1976, p. 11.

_____ 8. What might be the best title for this map? (a) Regions of the World (b) Energy Supply and Demand in World Regions (c) How Demand Affects the Price of Oil (d) Methods for Finding and Transporting Energy.

True or False?

_____ 9. In Western Europe the supply of oil is greater than its need for oil.

_____ 10. Middle East nations have more oil than they can use at the present time.

_____ 11. South Africa has plenty of oil.

_____ 12. There are large oil supplies in the Soviet Union.

_____ 13. Japan is probably an oil **exporting** nation.

_____ 14. In the Middle East, the oil lies near the land surface, and supertankers provide an energy-efficient and fairly cheap means of transporting the oil to world markets. This means that (a) profits will be low (b) profits will be high (c) costs will be too high (d) oil will be imported into the Middle East.

Name _____

Date _____

_____15. Which one of the following uses the **largest** share of the world's oil, natural gas, and coal? (a) a few highly industrialized countries (b) the many developing nations (c) OPEC (d) Japan.

_____16. Which energy source is used to do most of the cooking and heating in developing nations? (a) oil (b) wood (c) coal (d) water power.

_____17. A company having factories and oil wells in more than one country is called (a) a universal company (b) an independent company (c) a multi-national company (d) a national agency.

_____18. Which of the following items do the Middle Eastern oil producers probably not import? (a) gasoline (b) computers (c) cars (d) lumber.

_____19. What fraction of the world's total annual oil product is used by the U.S.? (a) 5% (b) 15% (c) 30% (d) 65%.

_____20. About what percentage of the oil and oil products used in the U.S. are imported? (a) 1% (b) 10% (c) 50% (d) 75%.

Instructor Information. . .

Energy in the Global Marketplace

Pre and Post-Test

For test items 1 to 7 write the letter of the best answer.

D 1. What energy supply in the Middle East is one of the world's largest? (a) wood (b) hydroelectric power (c) coal (d) oil.

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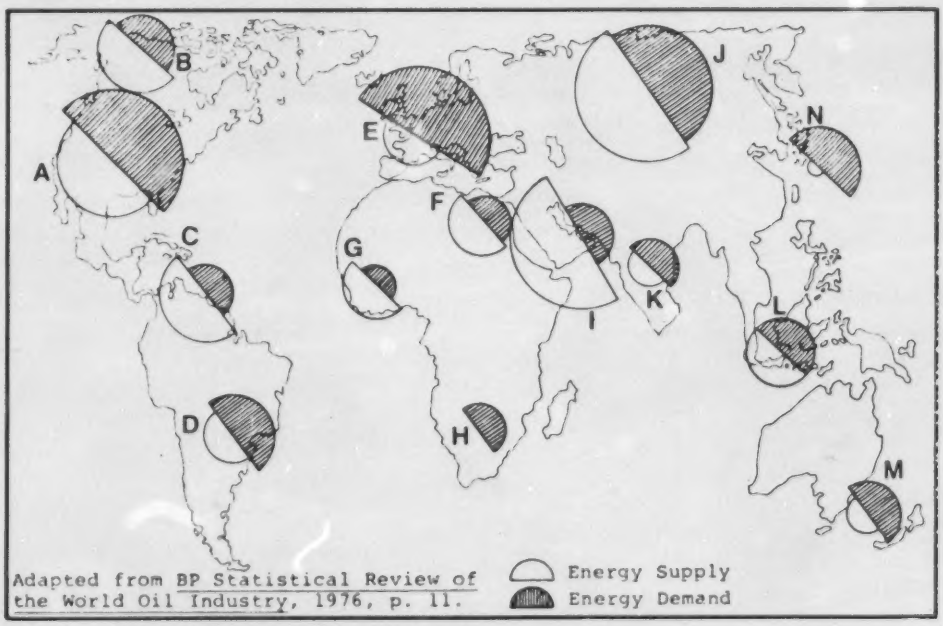

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C 20. About what percentage of the oil and oil products used in the U.S. are imported? (a) 1% (b) 10% (c) 50% (d) 75%.

Instructor Information. . .

"The History of Oil"

Rationale:

As a nation, we are still very dependent on oil as a source of energy. Oil has played an important role in our past as well as present society. In examining the history of oil, students will develop an understanding of oil's use; its rapid development, and its exhaustible properties.

Student Objectives:

Students will be able to identify new vocabulary words and use them correctly in sentences.

Students will be able to read and discuss "The History of Oil" and "The Origin, Occurrence, and Production of Oil."

Implementation:

The pre-reading vocabulary activity should be completed before the story "The History of Oil" is read. It allows students to become familiar with words they will see in the story.

It is suggested you read **all** the words and their meanings, then read the directions for the sentence completion activity, and allow students time to complete the activity. Finally, the stories "The History of Oil" and "The Origin, Occurrence and Production of Oil," can be read aloud or silently in large or small groups.

Debriefing:

Review the vocabulary worksheet with students. Optional: Have students create their own sentences using these words or others. As students read the stories, you can have them paraphrase or answer questions you develop to check comprehension.

The History of Oil

Pre-reading Vocabulary
Worksheet, Page 1

Name _____

Date _____

The words below are located in the reading, "The History of Oil." Read and study them, then complete the following activity.

New Word	Meaning in Story
1. ascribed	attached, connected
2. bituminous	tar-like substance
3. brinewell	salt water wells
4. contaminated	polluted, tained
5. derrick	framework or tower over an oil well
6. deterrent	discouragement
7. frothed	foamed
8. illuminant	lighting fuel
9. inflammable	combustible
10. lubricant	emulsion
11. manifestation	example, representation
12. naphtha	petroleum distillate
13. persistence	insistence, tirelessness
14. petroleum	oil, liquid from which gas is derived
15. pitch	a type of mortar
16. reputed	reported, considered
17. syndicate	merger, alliance
18. tedium	routine, dullness
19. vignetted	sketched
20. visionary	imaginary

Name _____

Date _____

Directions: Choose the correct vocabulary word and write it in the sentence. Be careful with your spelling!

1. In 1975, 44% of the total U.S. energy resources consumed were _____ and its products. (petroleum, lubricant)

2. Archaeological evidence indicates that in ancient Persia (now Iran) and Mesopotamia (now Iraq); a form of asphalt, sometimes called bitumen, or _____, was used for medicinal purposes and as a bonding material instead of mortar. (pitch brinewell)

3. A strong smelling flammable liquid used chiefly as a solvent is _____. (tedium, naphtha)

4. Americans have _____ specific uses for petroleum. (ascribed, contaminated)

5. If there is an accident while petroleum is being transported across the ocean, the water can easily be _____. (frothed, contaminated)

6. Is the energy problem a _____ of our imagination? (deterrent, manifestation)

7. Many solvents derived from petroleum are _____ and are considered very dangerous. (inflammable, visionary)

8. The major job of petroleum refineries has been to produce large quantities of high quality fuels, _____, and related products. (derricks, lubricants)

9. The rotary cutting method now used most extensively for drilling deep wells involves thousands of feet of well casing and drill pipe, a _____, a substantial power source, drill bits, and drilling muds and chemicals. (tedium, derrick)

10. In the mid-19th century, relatively limited quantities of liquid fuels were being regularly produced in many countries, mainly as an _____ and for cooking. (ascribed, illuminant)

11. Edwin L. Drake demonstrated _____ in his search for oil. (brinewell, persistence)

12. It has been _____ that Americans could save many barrels of oil each year if they would carpool much more. (reputed, ascribed)

Name _____

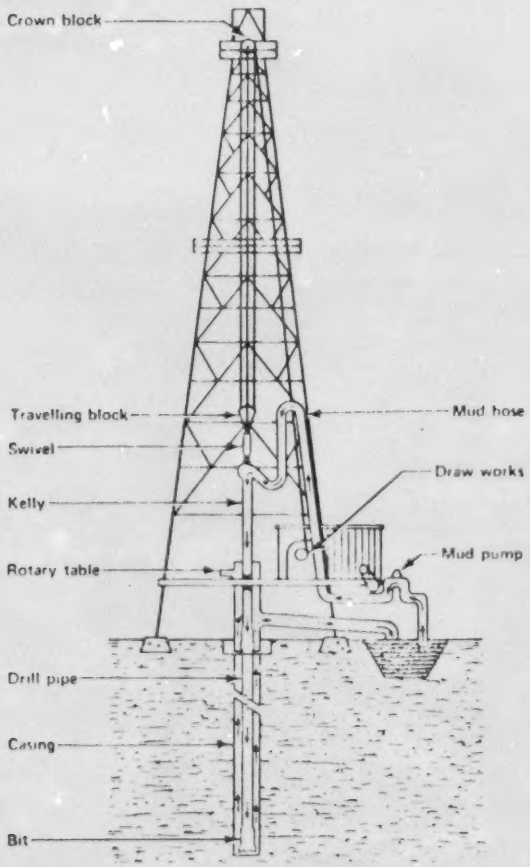
Date _____

13. A _____ contains salt water. (pitch, brinewell)

14. Oil drillers can become discouraged with the _____ of drilling if they can't find oil. (petroleum, tedium)

15. Drilling without success can be a _____ in the continuing search for oil.

ROTARY DRILLING RIG



Name _____

Date _____

oil and gas-sacred symbols

Primitive man **ascribed** divine powers to fire and water. There is evidence that oil and natural gas seeping from the earth when set afire, perhaps by lightning, were paid devotion as a sacred element. The Zoroastrians, or "Fire Worshippers," built their altars near the burning gas seepages at Baku on the Caspian Sea, and rendered homage to this **manifestation** of a great imprisoned spirit.

Oil in the Ancient World

early uses of petroleum

Ancient peoples used **petroleum** centuries before the Christian era. Noah caulked the ark with **"pitch,"** evidently a form of **petroleum** gathered from the seepages of Mesopotamia. Job told of a rock which "poured me out rivers of oil." The "slime" used as mortar in building the Tower of Babel and other ancient structures is believed now to have been **petroleum.** Nehemiah is **reputed** to have used oil for altar fires. He called it "naphtar" of "nephtoj," from which may have been derived the modern word **"naphtha."** Ancient Egyptians used pitch as an axle grease for their primitive chariots.

oil as a weapon

Numerous legends indicate the Greeks recognized the usefulness of oil. They destroyed a Scythian fleet by pouring oil on the sea and setting it afire. Belisarius, famous general of the later Roman Empire, adapted this idea of using "burning water." In his campaign against the Vandals in northern Africa, he smeared swine with oil, ignited the oil, and drove the squealing, blazing porkers into the terrified ranks of the enemy. Crude oil mixed with ashes served the Syrians as fuel. There are records indicating that the early Chinese made use of both oil and natural gas.

petroleum ointments and medicines

The early uses of **petroleum** were so remarkably varied as to be almost prophetic of its many and various modern uses. Yet **petroleum** is mentioned more frequently in legend and in early history as a medicine for the ills of man and beast than for any other purpose. The first Europeans coming to America found the Indians using crude oil as a medicine and as an ointment, while certain tribes regarded oil springs with religious reverence. The early settlers of New York, Pennsylvania, and Ohio considered "rock oil," as they called it, a potent cure for every type of ailment.

Colonial America Finds Oil

petroleum springs

The possibilities of oil were not entirely lost upon **visionary** minds among the American colonists. George Washington, visiting what is now part of West Virginia in 1753, learned of the existence of oil in the Kanawha River Valley. He recognized its possible importance sufficiently to acquire petroleum-bearing lands. Listed in his will as among his more valuable holdings was a tract containing a "burning spring." He wrote:

"This tract was taken up by General Lewis and myself on account of the **bituminous** spring which it contains, of so **inflammable** a nature as to burn as freely as spirits and is as nearly difficult to extinguish."

Name _____

Date _____

salt and oil wells don't mix

Benefit and Nuisance

Although oil, commonly used as a medicine in the United States of 1800, was regarded by some as a benefit, others saw it only as a nuisance. They were the **brinewell** operators of Pennsylvania, Ohio, West Virginia, Kentucky, and Tennessee upon whom the country was largely dependent for its supply of salt. The presence of **petroleum** which **contaminated** salt or salt water in underground beds was a misfortune which too frequently necessitated the abandonment of productive salt wells.

business makes money on oil

Oil as a Sideline

Some enterprising businessmen, however, utilized this stepchild of the salt brine wells. Best remembered of them is Samuel M. Kier, a salt merchant, who built a profitable side line business by bottling **petroleum** and selling it as "Kier's Rock Oil," as a medicine. In advertising, he used reproductions of American "greenback" bills of various denominations, on which were **vignetted** pictures of his plant at Tarentum, Pa., and the **derricks** used in boring and pumping the brine wells.

oil for lighting

oil as a lubricant

Light and Lubrication

As early as 1819 **petroleum** had come into demand as an **illuminant** for homes and factories in Ohio because of the increasing shortage of whale oil, up to then the principal **illuminant** other than tallow candles. Larger cities throughout the world had taken a page from Herodotus (circa 450 B.C.) and were using "coal-oil" and coal-gas lamps for street lighting. Attention also was being focused upon oil by Adolph Schreiner's invention of the first modern oil-burning lamp in Vienna in 1850, and by the search for a **lubricant** capable of overcoming friction, principal **deterrent** to continuous operation of newly developed industrial machinery.

"Greenbacks" and Ideas

the American Petroleum Industry

"Rock oil" or **petroleum** came to attention as having value as an **illuminant** and as a **lubricant.** One day in the summer of 1857, George H. Bissell, a New Haven, Conn., businessman visiting New York, saw in the window of a Broadway drugstore a display of "Kier's Rock Oil" with their pictures of salt-well **derricks.** Bissell and some friends recently had acquired a 100-acre tract of land having an "oil spring" near Titusville, Pa. They had received from Professor Benjamin Silliman, of Yale University, a favorable report on the use of **petroleum** as an **illuminant.** It occurred to Bissell, as he gazed into the window, that the Titusville spring might be increased in oil production by boring and pumping just as salt properties were developed.

Drilling for Oil

Drake— father of the American Petroleum Industry

Bissell's **syndicate** engaged a 40-year-old railroad conductor as director and superintendent of the Titusville properties of the Pennsylvania Rock Oil Company and the successor Seneca Oil Company. His name was Colonel Edwin Laurentine Drake. He was destined to become known as the founder of the American **petroleum** industry by reason of being the driller for the first commercial oil well.

Drake reached Titusville in May 1858, and immediately encountered difficulty in obtaining working associates with sufficient zest for experiment to abandon the primitive method of obtaining oil by digging trenches and collecting the natural seepage. For weeks Drake had to struggle with the difficulties of boring a well.

"Drakes Folly"

In April 1859 he obtained the services of William A. Smith, Tarentum blacksmith, who had had experience in drilling brine wells, and of his sons, Samuel and James. Drilling operations were begun in June near an old spring on the bank of Oil Creek. Numerous delays and discouragements harassed the drillers, and the project had won the name of "Drake's Folly" even before hard rock was encountered at 36 feet.

"Yankee" ingenuity

To Drake's credit was the first use of a "drive pipe" to keep earth from caving as the hole was bored deeper. He also used a steam engine to raise the drill suspended from a crossbeam, thus eliminating the hard physical labor of the "spring pole" arrangement used by the Chinese for centuries before. In those ways "Yankee" ingenuity made its first expression in creating an industry that is typically American in its orgin and in its worldwide influence.

Name _____

Date _____

Oil is Struck

discouragement

oil business is born

Drake's **persistence** and "Uncle Billy" Smith's primitive drilling machinery became the butt of jokes. Friends tried to dissuade them. Even Drake's employers became discouraged with the **tedium** of drilling only three feet of rock a day. The oil, they said, might be hundreds of feet down.

Late one sultry summer afternoon "Uncle Bill" and his son, Sam, withdrew the iron bit from the well to measure this depth, which previously had been 69½ feet. When the bit was within a few feet of the top, a dark-green liquid bubbled and **frothed.** Rigging a crude bailer, they lifted several gallons of oil to the surface. Then "Uncle Billy" mounted his mule and started for Titusville, a mile away, carrying a sample to prove to the countryside that "Drake's Folly" was a dream come true. And the American oil business was born!

Some Common Misconceptions

For seventy years after Colonel Drake drilled his well in 1859 people knew relatively little about oil in the earth. In ignorance, many strange and many romantic ideas were expressed, some of which persist to this day.

A common belief is that oil lies in the earth as a river or lake extending under and flowing beneath large areas. Some of the early law pertaining to oil and gas was based upon that notion. A tale was told of a driller who lost his watch down a well in Pennsylvania and, years later, found it in the oil flowing from a well in Texas. Even today many people think an oil "pool" is a body of liquid, like water in a cistern, and that one can siphon or pump oil out of the earth at any rate desired, until the pool is empty. Nothing is farther from fact. The truth is that oil (petroleum) is found in rock. Indeed, its name is derived from the Latin words "petro" meaning rock, and "oleum" meaning oil. Nevertheless, long usage has fixed the word "pool" as equivalent to a quantity of oil dispersed in rock in the earth. The word, therefore, has special meaning in the oil business.

oil dispersed in rock

Another common misconception is that oil flows out of the "pool." The public thinks of an oil well as a "gusher" spouting forth wealth and riches to the owner of a well. The facts are that oil cannot produce itself from the earth; that there is nothing in oil itself which causes it to rise up and flow out of wells; and that oil moves into a well only if it is pushed or expelled from rock by the gas and water associated with it, supplemented in many cases by the force of gravity.

oil moved by gas and water

The Drama of Oil

The user of liquid fuel in a late-model, streamlined automobile is rarely aware that he is a participant in the final act of a fascinating drama whose scenes span a period of several hundred million years. Nevertheless, such is the case when gasoline is burned in the engines of motor vehicles. The consumption of lubricants, kerosene, diesel fuel, and other petroleum products marks the end of this drama.

consumption: end of a long process

The age of the earth is almost incomprehensible. It is estimated to be more than two billion years. The major changes that affect the surface of the earth have been, and continue to be, scarcely perceptible during the lifetime of an individual. However, given sufficient time, nothing is more changeable than the "everlasting" hills. The mountains of today are of relatively recent age, geologically speaking. Many of them occur in areas that have been repeatedly occupied by the sea. In many instances ancient sediments left by the sea carry fossil remains of marine life. After the mountains are worn away through the slow processes of erosion and the waste material is transported to lower areas, including the ocean, the sea may return to submerge extensive areas of land. Later, portions of the eroded lands again may be raised into mountains or highlands. The newly created landscapes in turn yield to the same erosional and deformational processes. Over a period of hundreds of millions of years the cycle of land destruction, submergence, deposition, and elevation may be repeated over and over again with greater or less intensity.

lifecycle of sediment and land formation

Instructor Information. . .

"What is an Energy Gulf?"

Rationale:

The world's known oil reserves are located in places where water once covered the land. Millions of years ago, ocean plant and animal life lived where present-day oil can be found. Through physical and chemical processes, these remains have been transformed into petroleum. This lesson introduces students to the processes of petroleum formation and to the fact that oil often migrates through cracks and porous rock and is formed some distance from the place where the marine organisms were deposited and subjected to high pressure and temperature.

Student Objectives:

Students will be able to discuss the location of oil accumulations.

Students will be able to find similarities and note differences in two regions on a map.

Implementation:

Ask students if they have ever heard of Shell Oil. What does the sign look like? Why did the company choose to use a shell as a symbol? Why do you think another company uses the name Gulf Oil? Why "gulf?" Point out that this lesson has something to do with gulfs and the ocean. They are to think of these things as the lesson continues. At the end, ask students to find links between these words and what they have learned.

Focusing student attention towards a map or globe, point out the Gulf of Mexico and the Persian Gulf region. **Note:** Develop a working definition of "gulf" and discuss other related terms such as "bay," "fjord," and "inlet."

Distribute copies of the student worksheet which contains maps one (1) and two (2). Have students label the numbered continents on map 1. They may use map 2 to assist them with spelling and identification.

Next, have students examine the map of the world as it may have existed 150 million years ago (Map 2). You may want to introduce this map by saying that scientists believe that forces capable of moving whole continents operate within the earth; that the map of the world did not always look as it does today; that the earth's surface is dynamic, divided into pieces (sometimes called plates) floating on a more viscous inner mantle. Continents riding on these plates have drifted away. Sometimes they joined other continents and split from others in many ways, each time changing their outlines.

The continents are still drifting. The Pacific Ocean is getting smaller each year, and the Atlantic Ocean is slowly growing wider; so slowly, however, that it can hardly be measured.

Instructor Information. . .

Introduce oil formation in these gulf areas by mentioning that scientists now believe that great oceans covered large parts of the world's surface millions of years ago. As tiny plants and animals in the oceans died, their remains settled on the muddy bottoms. Then bacteria caused them to decay. More mud and sand covered the decayed plant and animal matter. Mud and sand are called "sediments." As sediments builds up, pressure from the enormous weight caused the mud and sand to form sedimentary rocks called shale and sandstone.

During this process pressure and heat caused molecules in the plants and animals to change into petroleum. The heat drove the oil out of these rocks and into other layers of sedimentary rocks and sealed the oil in underground reservoirs.

Hand out Map 3. This map shows your students where these concentrations are located today.

Help students locate and name these areas, and answer each question. (Answers are on the teacher map.)

Using "World Petroleum Producing Areas — 1977," students can answer the questions given.

Finally, at a later time and as part of a review, students can answer questions on the worksheet "Summing Up." Also, have them now recall why "shell" and "gulf" are words used in naming oil companies.

Debriefing:

Most debriefing will take place through class discussion of worksheets. Also, the worksheet labeled "Summing Up" can be used to obtain a good idea about student retention of the basic concepts of the unit.

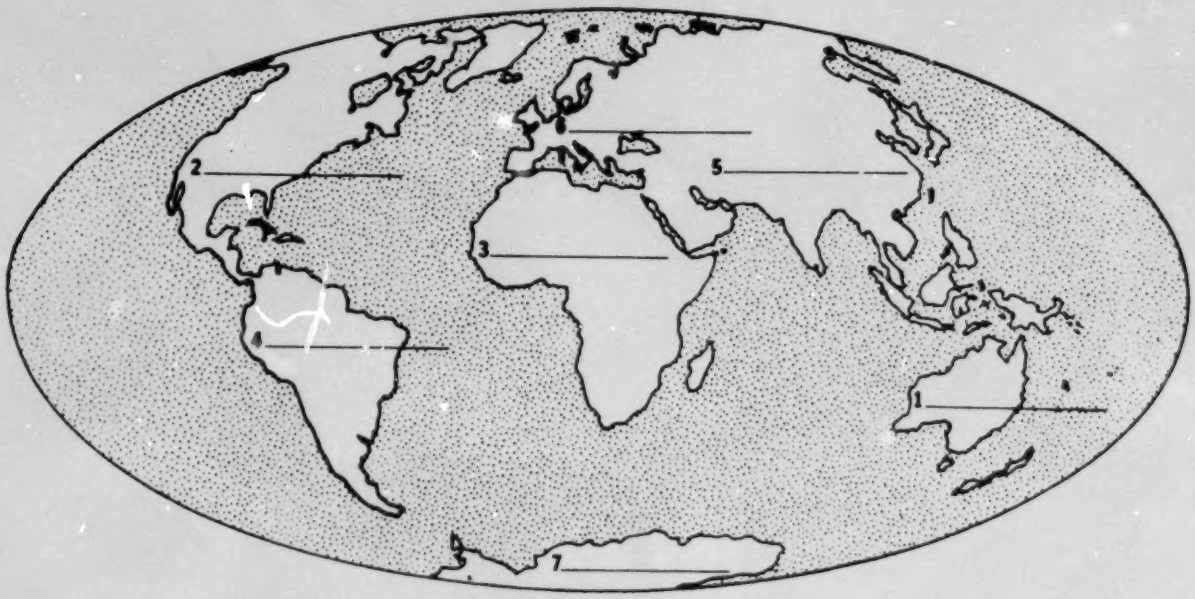
Two Energy Gulfs
Worksheet, Page 1

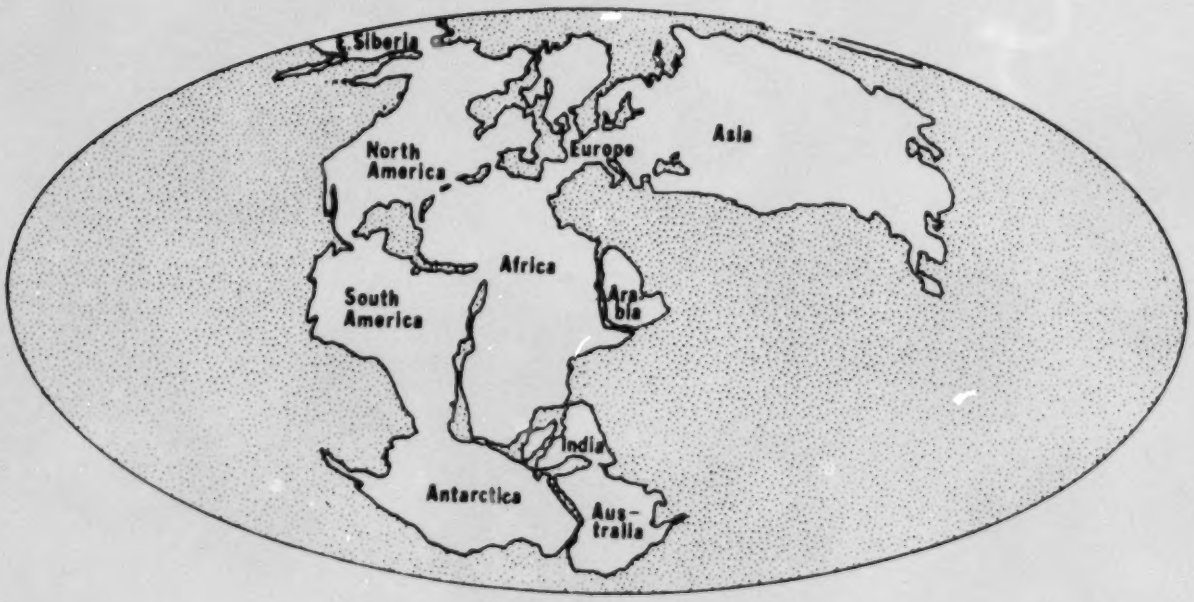
Name _____

Date _____

Directions: Label the numbered continents on Map 1.

Map 1: The World As It Is Today





Map 2: The World 50 Million Years Ago

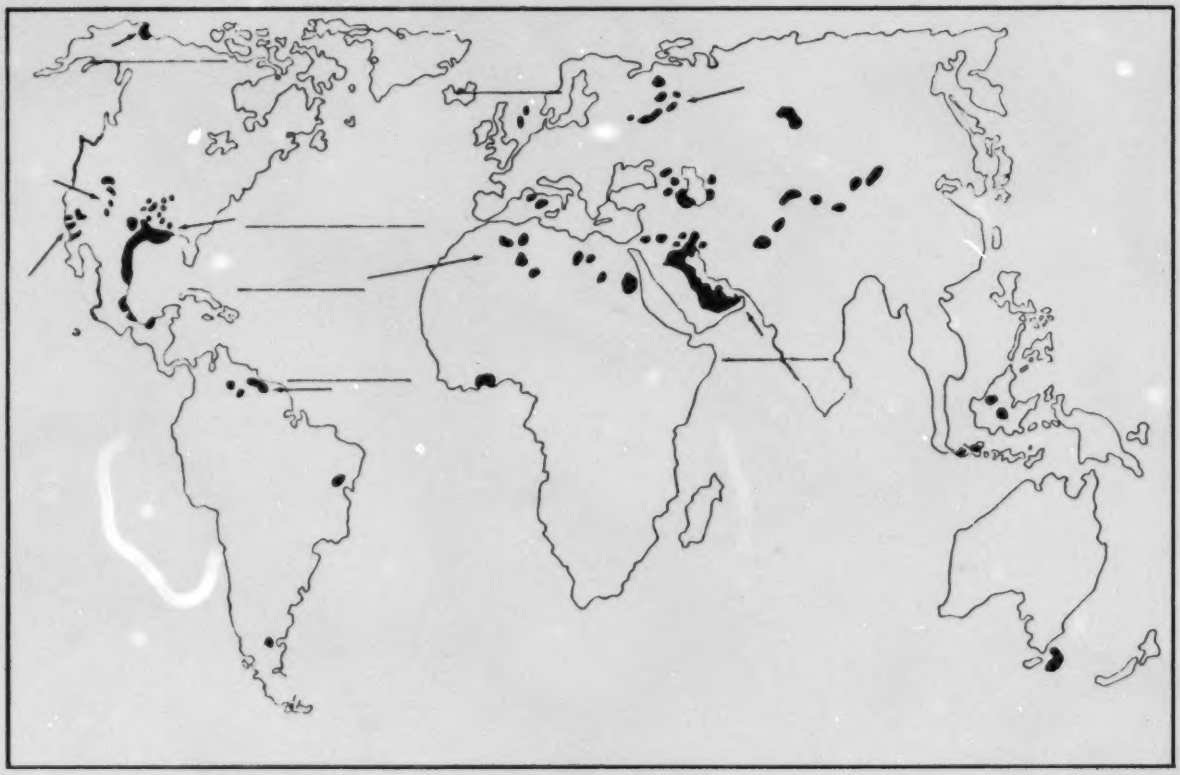
Name _____

Date _____

Map 3: Major Oil Accumulations

The map below shows where major oil accumulations exist. Can you name these places? Put the letters **GM** where you see the Gulf of Mexcio; **LM** for Lake Maracaibo (Venezuela); **AL**, Algeria and Libya; **PG**, Persian Gulf; **NS**, North Sea; **PB**, Prudhoe Bay (Alaska).

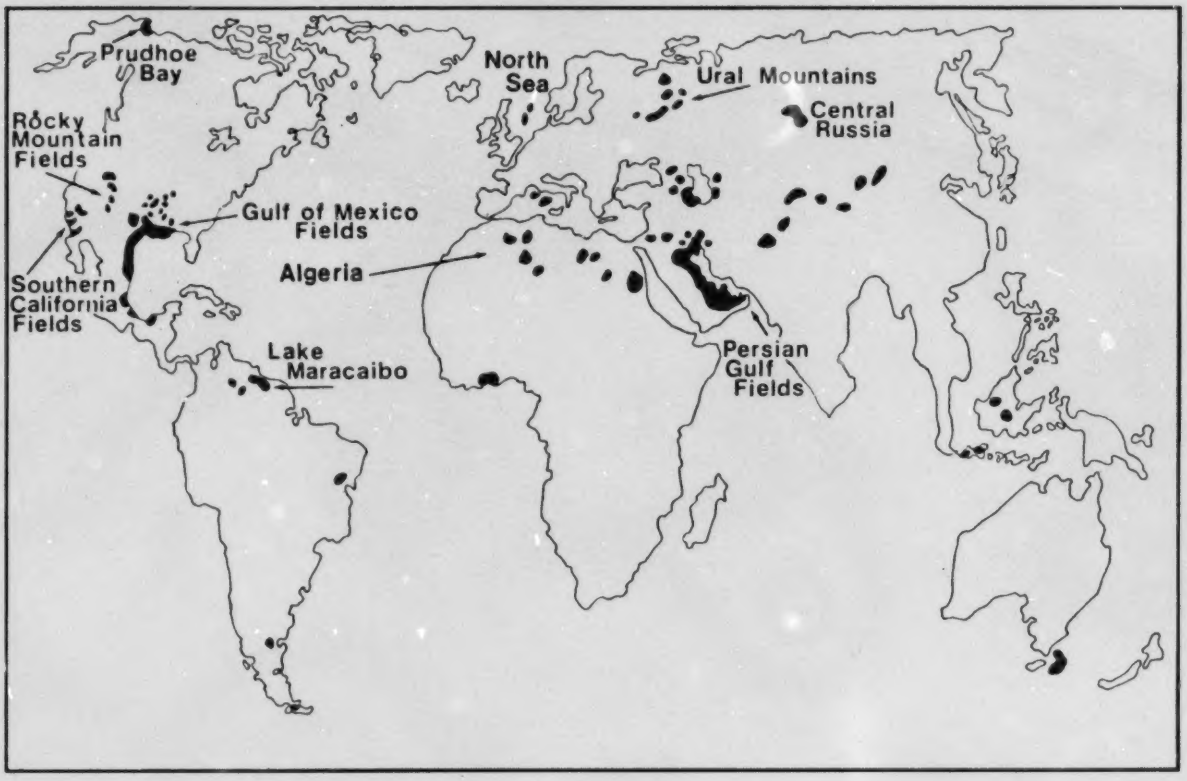
Use an atlas to check your answers.



Name _____

Date _____

World Petroleum Producing Areas — 1977



1. What energy source is shown on the map? _____

_____

2. What is another word for petroleum? _____

3. The map shows many large oil producing areas. Which are the two largest?

   A. _____

   B. _____

4. What word is used in both of these large oil fields& _____

5. Look carefully at the map. How would you describe a gulf? _____

_____

_____

6. What is an energy gulf? _____

_____

_____

_____

Name _____

Date _____

Summing Up

Directions: From what you have learned, answer the following questions in complete sentences.

1. What is a continent?

2. What are the names of the world continents? (There are seven.)

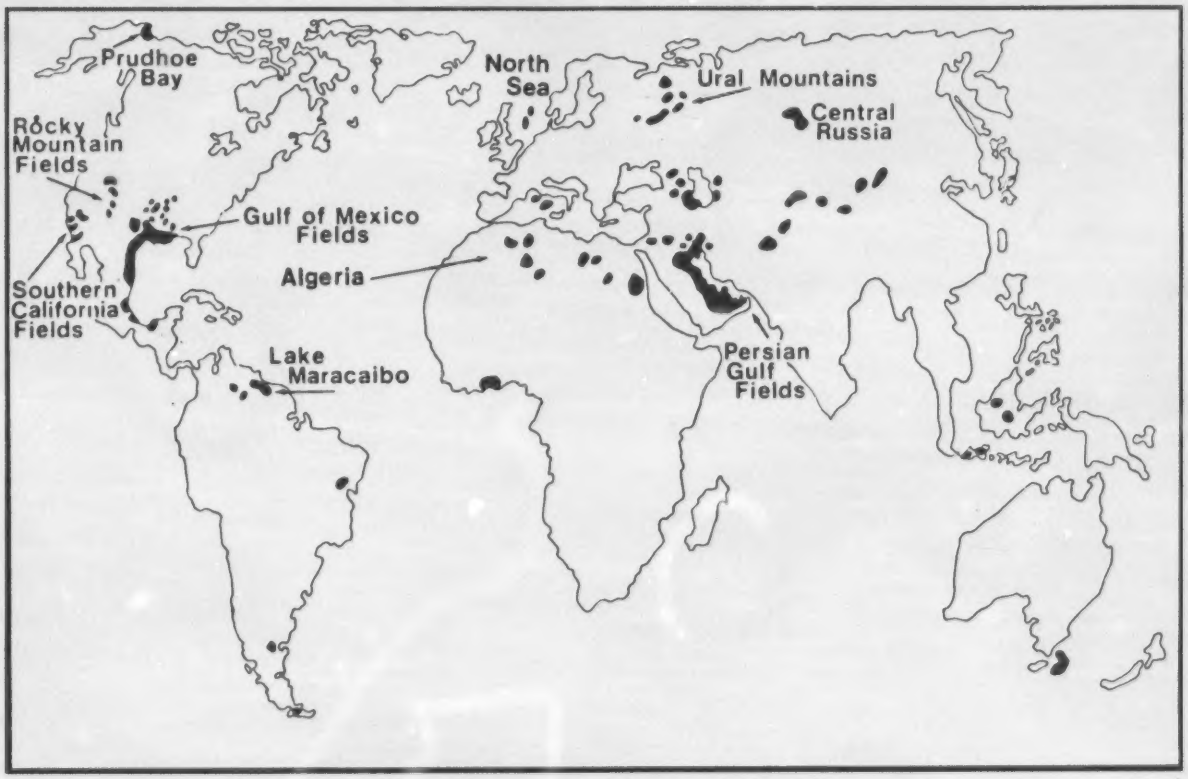
3. What did the world's land look like 150 million years ago?

4. What elements eventually were made into petroleum?

5. What things would you look at, if you had the job of finding oil?

Instructor Information. . .

Map 3: Major Oil Accumulations



The map above shows where major oil accumulations exist. Have students name these places. Put the letters **GM** where you see the Gulf of Mexico; **LM** for Lake Maracaibo (Venezuela); **AL**, Algeria and Libya; **PG**, Persian Gulf; **NS**, North Sea; **PB**, Prudhoe Bay (Alaska). Have students name the other places as well.

Use an atlas to check your answers if possible.

Instructor Information. . .

Summing Up

1. What is a continent?
   (A continent is a large land mass.)

2. What are the names of the world continents?
   (The continents are: North America, South America, Eurasia (Europe and Asia), Australia, Africa, and Antarctica.)

3. What did the world's land look like 150 million years ago?
   (Millions of years ago the continents were pushed much closer together.)

4. What elements eventually were made into petroleum?
   (The general movement of the waters made ancient plant and animal life collect and settle in coastal waters, making these areas particularly rich in today's oil and gas.)

5. What things would you look at, if you had the job of finding oil?
   (I would look at what the currents in the ancient oceans might have been, where the gulfs were, what the geologic formations are now.)

Instructor Information. . .

"Super Size"

Rationale:

Super tankers like the one shown in this activity are called **Ultra Large Crude Carriers.** The ULCC shown is the **Esso Atlantic.** It is 1,148 feet long, 230 feet wide, has a draft of 92 feet, and carries 508,731 tons or about 160,000,000 gallons of oil. There are no existing ports in the United States capable of handling these mammoth ships. Some countries in the Persian Gulf have begun building their own super tanker fleets, perceiving correctly that transporting oil by tanker is the most economical method. This activity, then, is designed to help students deal with size and large amounts. As such, it will help them describe sizes in numbers.

Objectives:

Students will be able to estimate size and make comparisons of sizes.

Students will be able to describe quantitatively the size of a super tanker.

Students will be able to discuss the pros and cons of super tanker ports.

Implementation:

Duplicate the picture of the super tanker and give one to each student, or use the picture as a transparency. Ask: "How many football games could be played at the same time on the deck of a super tanker?" (three) "If one football field is 120 yards long, if you include the end zones, how many yards long is a super tanker? How can you prove it?" (360 yards: multiply 120 x 3).

Point out to students that this sum is equal to three (choose the name of the local college or high school football field to insert here) _____ football fields!

Ask students if they can think of other comparisons.

Turn the class' attention toward the question of how much fuel can be transported in one of these giants of the sea. Ask: "How many barrels of oil can a super tanker hold?" (see picture) "How many cars can the tanker fill up, if a car could use crude oil directly? How would you figure the amount in cars if we say that each car tank holds 20 gallons?" (160,000,000 ÷ 20 = 8 million cars.) Distribute the problem sheet called "How Big? How Long? How Much?" to students. Ask them to complete each question. (Instructor Information follows this activity).

Debriefing:

Use the worksheet "Super Size" to discuss the dimensions of the tanker. Then have students complete the worksheet "Super Tanker." This may be difficult for those students weak in basic math skills so assistance will be necessary. Check answers with the class.

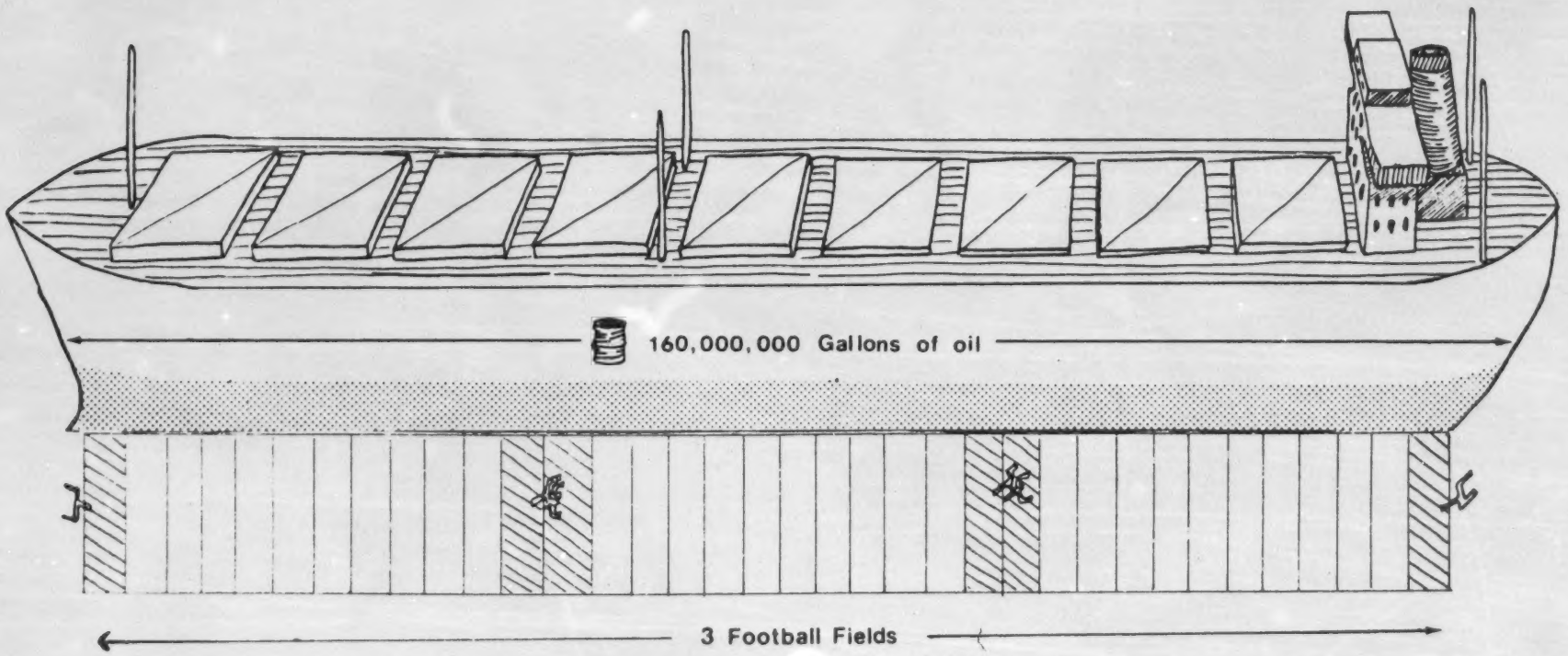
Super Size
Worksheet, Page 1

Name _____

Date _____

Super Tanker

(Ultra Large Crude Carrier — ULCC)



Name _____

Date _____

How Big? How Long? How Much?

Directions: Using the picture of the super tanker, answer these questions.

1. The average classroom is 30 feet (915 cm) long. How many classrooms would equal the length of the super tanker which is 1,150 feet* (35,075 cm)?

_____

2. The average car is 16 feet (4888 cm) long. How many cars would equal the length of the super tanker?

_____

3. The average student in your grade is 5 feet tall. How many of your classmates, lying head to toe, would equal the length of the super tanker?

_____

4. We know a super tanker is 1,150 feet (350.75 m) long*. It is also 230 feet (70.17m) wide. How many square feet are on the surface?

_____

5. If a car is 16 feet (488 cm) long and 6 feet (183 cm) wide, what is the area of the car?

_____

6. How many cars can fit on the surface of the super tanker?

_____

7. A tanker carrying 55,000,000 gallons (208 million liters) of oil can supply an average family car with enough gas to make nine trips to the sun and back. The sun is 93,000,000 miles (148.8 million km) from the earth. The super tanker holds 160,000,000 gallons (605 million liters) of oil. How many round trips to the sun and back could the family car take with this amount of oil?

_____

*The **Esso Atlantic** is 1,148 feet long, 230 feet wide, has a draft of 92 feet, carries 508,731 tons or about 160,000,000 gallons of oil.

Instructor Information. . .

1. The average classroom is 30 feet (915 cm) long. How many classrooms would equal the length of the super tanker which is 1,150 feet* (35,075 cm)?
   (1,150 ÷ 30 = 38 classrooms or 35,075 ÷ 915 = 38.)

2. The average car is 16 feet (4888 cm) long. How many cars would equal the length of the super tanker?
   (1,150 ÷ 16 = 72 cars or 35,075 ÷ 480 = 73.)

3. The average student in your grade is 5 feet tall. How many of your classmates, lying head to toe, would equal the length of the super tanker?
   (1,150 ÷ 5 = 230 students or 35,075 ÷ 153 = 229).

4. We know a super tanker is 1,150 feet (350.75 m) long*. It is also 230 feet (70.17m) wide. How many square feet are on the surface?
   (264,500 square feet; 24,612 m).

5. If a car is 16 feet (488 cm) long and 6 feet wide (183 cm) wide, what is the area of the car?
   (96 square feet or 89,300 cm^2.)

6. How many cars can fit on the surface of the super tanker?
   (264,500 ÷ 96 = 2,755 cars or 246,050,000 ÷ 89,300 = 2,755.)

7. A tanker carrying 55,000,000 gallons (208 million liters) of oil can supply an average family car with enough gas to make nine trips to the sun and back. The sun is 93,000,000 miles (148.8 million km) from the earth. The super tanker holds 160,000,000 gallons (605 million liters) of oil. How many round trips to the sun and back could the family car take with this amount of oil?
   (160,000,000 ÷ 55,000,000 = 2.9 or 605 (million liters) ÷ 208 (million liters) = 2.9 then 2.9 x 9 = 26.1 round trips.)
   55 million ——— 9 round trips
   160 million ——— 26.1 round trips

*The **Esso Atlantic** is 1,148 feet long, 230 feet wide, has a draft of 92 feet, carries 508,731 tons or about 160,000,000 gallons of oil.

Note: Help students see that a fraction is significant in this example. You might mention that if you have an extra 1/10 a round trip (which you would be if you rounded 26.1 to 26), you are left somewhere out in space.

Instructor Information. . .

"The Wreck of the Amoco Cadiz and its Effects on the Environment"

Rationale:

The processes of extracting and transporting oil from one location to another can be difficult and dangerous. This activity addresses those risks involved. Students will examine a newspaper account and a story which tell of an oil spill.

Student Objectives:

Students will be able to identify some of the dangers and risks involved in oil drilling and transportation.

Implementation:

Distribute copies of **The Wreck of the Amoco Cadiz.** Have students read the news article of how the oil spill happened, and then the story of the oil spill aftermath. The questions at the end of the story will serve to help students recall important short and long-term effects on the lives of people and on living organisms as a result of tanker accidents.
Answers to student activity tasks follow the activity.

Debriefing:

Students are directed to circle and underline certain elements of the story. They can then answer questions to the story. You may want to have students share their suggestions following question 10.

Name _____

Date _____

March 19, 1978

The Wreck of the Amoco Cadiz

Supertanker Breaks Apart Off Coast of Northern France

The people of France are cleaning up after the fourth major tanker wreck off the coast of Brittany in eleven years.

On March 16, 1978 the **Amoco Cadiz,** carrying 230,000 tons (over 70 million gallons) of light crude oil from the Middle East ran aground when the captain ordered the engines stopped after the ship's steering mechanism jammed.

Rough seas prevented other ships in the area from unloading the oil before the **Amoco Cadiz** broke in two in the shallow waters off the French coast.

French government officials are meeting to decide how to prevent further shoreline damages. The French Navy has been instructed to enforce an order preventing tankers from passing within seven miles of the coast.

The Wreck of the Amoco Cadiz
Effects on the Environment

Name _____

Date _____

Shoreline Impact of an Oil Spill

reflecting on events

I think I noticed him standing there on the beach simply because he was the only person not moving quickly around. Everyone else seemed to be lifting something, or brushing something, or hauling buckets of things to some place away from the edge of the sea. He stood, still and quiet, his feet buried in hundreds of thousands of dead sea snails, his right hand touching clusters of periwinkles dying on nearby rocks. I saw him reach down to lift one tiny snail out of the blackened pile, and watched him try to brush away the oil with the sleeve of his sweater. Then I saw him drop the snail among its dead and dying brothers and turn with angry eyes toward the sea.

the lifeless supertanker

There in the mist, looking like some broken-backed sea monster, lay the supertanker, **Amoco Cadiz,** dead among the restless waves. Its cargo of oil spread mile upon mile across the waves. Here on the shoreline the oil coated everything it touched with a thick, black ooze.

recording damage to sea life

The man was a marine biologist. It is his job to help assess the damage to sea life in this region and to keep a record of its recovery from the spillage of sixty-six million gallons of crude oil. He knows the effects will be major and varied. To his relief there has been no gigantic fish kill reported. But oysters and other shellfish will have to be measured carefully to find out when the levels of petroleum hydrocarbons will go down enough to make them edible again.

animal and plant damage

He saw beaches as far away as sixty-five miles from the spill paved with dead sea urchins, razor clams, and dead snails. Now he is especially interested in finding out how much damage has been done to seaweed and kelp.

farming the sea

The people of Brittany in Northern France farm the sea like they do the land. They raise and harvest seaweed as we do wheat and corn and use it for medicines, food, and fertilizers. The biologist is sure that this year's crop is surely ruined. What, he wondered, will happen if the reproductive cells of seaweed have been ruined as well. How could new colonies of these important seaweeds get started again?

Name _____

Date _____

damage to bird life

Early scientific data tend to show that sea birds have been harmed by the oil. Over 5,000 dead birds were found along the shore, and hundreds more are struggling for life in makeshift bird hospitals. But the outlook for these oil-soaked birds is grim. Oil and sea birds simply don't mix.

sea birds dying

Sea birds have thick feathers. This thickness provides almost perfect insulation from cold water. Oil destroys the structure of the feathers and exposes the bird's skin to freezing water. In addtion, the bird loses much of its ability to float as the layer of air trapped between body and feathers disappears. As a result the bird rides lower in the water, and most likely can no longer feed itself.

slow death

If the bird does not die of starvation, it will sooner or later die from exposure. But the creature may float around for days, its heart beating in double time to compensate for the heat loss. Perhaps the end will be hastened by swallowing some of the oil, which acts like a poison. But what if a bird is rescued, what are its chances? The biologist would have to shake his head. Bird rescues have not had much success in the past. Most rescue operations work in the same way—with the same poor results. First the bird is cleaned with mineral oil, and then the feathers air dried. However, the bird's delicate system does not recover quickly enough, and very few birds survive the cleaning and captivity.

the treating of birds

damage from clean-up

The bioloqist began to worry that clean-up techniques for beaches as well as the birds might be doing more damage to the ecosystem than oil itself. For example, will steam hosing and brush cleaning of rocks and sand cause a whole new set of biological problems to set in?

return to normal

It will be a long time before the shore will return to normal. For the present and for the near future, the cost to the people and to plant and animal life of Brittany has been immense.

38

The Wreck of the Amoco Cadiz
Effects on the Environment
Worksheet, Page 1

Name _____

Date _____

Directions: Find the following sentences in the story and complete these instructions.

1. Circle the sentence which describes the marine biologist's job.
2. Underline the names of plants and animals that have been damaged or killed by the oil.
3. Circle twice the sentences which describe the possible long-term damage to important seaweeds.
4. How are sea birds harmed by oil?

   _____

5. Write the sentence that tells how the people of Brittany use seaweed.

   _____

6. The second paragraph in the news story mentions why the ship went aground. What was the reason?

   _____

   _____

7. How much oil was the tankership carrying?

   _____

   _____

8. How did the French government decide to attack the problem of tanker oil spills damaging their shoreline in the future?

   _____

   _____

   _____

Name _____

Date _____

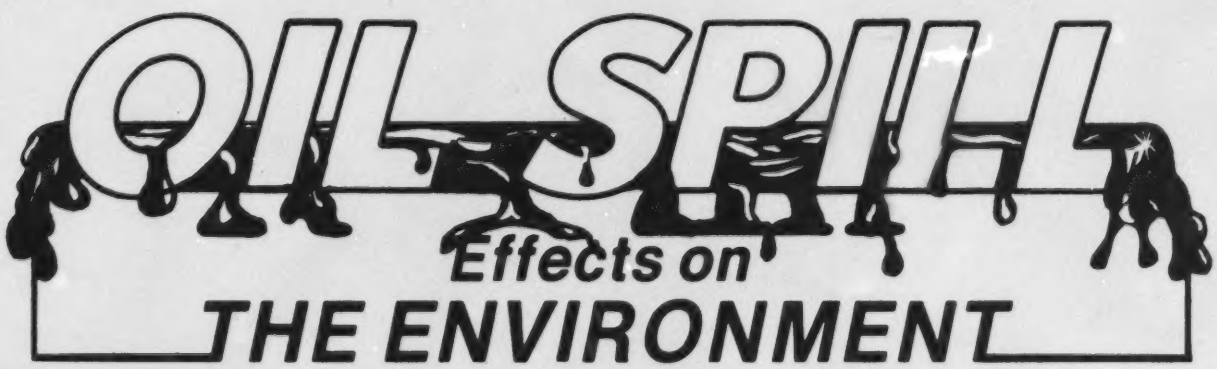
9. How might more problems arise from clean-up operations after the oil spill?

_____

_____

10. Describe what you think people were lifting, brushing, or hauling to safer places on the beach.

Probably Being Hauled Away	Things Being Brushed	Things Being Lifted



Instructor Information. . .

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Shoreline Impact of an Oil Spill

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He saw beaches as far away as sixty-five miles from the spill paved with dead **sea urchins, razor clams,** and dead **snails.** Now he is especially interested in finding out how much damage has been done to **seaweed** and **kelp.**

Instructor Information. . .

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Early scientific data tend to show that sea birds have been harmed by the oil. Over 5,000 dead **birds** were found along the shore, and hundreds more are struggling for life in makeshift bird hospitals. But the outlook for these oil-soaked birds is grim. Oil and sea birds simply don't mix.

Sea birds have thick feathers. This thickness provides almost perfect insulation from cold water. Oil destroys the structure of the feathers and exposes the bird's skin to freezing water. In addtion, the bird loses much of its ability to float as the layer of air trapped between body and feathers disappears. As a result the bird rides lower in the water, and most likely can no longer feed itself.

If the bird does not die of starvation, it will sooner or later die from exposure. But the creature may float around for days, its heart beating in double time to compensate for the heat loss. Perhaps the end will be hastened by swallowing some of the oil, which acts like a poison. But what if a bird is rescued, what are its chances? The biologist would have to shake his head. Bird rescues have not had much success in the past. Most rescue operations work in the same way—with the same poor results. First the bird is cleaned with mineral oil, and then the feathers air dried. However, the bird's delicate system does not recover quickly enough, and very few birds survive the cleaning and captivity.

The biologist began to worry that clean-up techniques for beaches as well as the birds might be doing more damage to the ecosystem than oil itself. For example, will steam hosing and brush cleaning of rocks and sand cause a whole new set of biological problems to set in?

It will be a long time before the shore will return to normal. For the present and for the near future, the cost to the people and to plant and animal life of Brittany has been immense.

Instructor Information. . .

Directions: Find the following sentences in the story and complete these instructions.

1. Circle the sentence which describes the marine biologist's job.
   (See teacher's copy.).

2. Underline the names of plants and animals that have been damaged or killed by the oil.
   (See teacher's copy. Students should also underline **periwinkles,** on first page of news account.)

3. Circle twice the sentences which describe the possible long-term damage to important seaweeds.
   (See teacher's copy.)

4. How are sea birds harmed by oil?
   (Oil destroys the structure of the feathers and exposes the bird's skin to freezing water. It loses its ability to float high enough in the water to get food. Oil is toxic.)

5. Write the sentence that tells how the people of Brittany use seaweed.
   (They raise and harvest seaweed as we do wheat and corn and use it for medicines, food, and fertilizer.)

6. The second paragraph in the news story mentions why the ship went aground. What was the reason?
   (The captain ordered the engines stopped after the steering mechanism jammed.)

7. How much oil was the tankership carrying?
   (230,000 tons.)

8. How did the French government decide to attack the problem of tanker oil spills damaging their shoreline in the future?
   (They decided to enforce the order preventing tankers from passing closer than seven miles of the coastline.)

9. How might more problems arise from clean-up operations after the oil spill?
   (Cleaning the rocks and sand may destroy delicate ecosystem.)

10. Describe what you think people were lifting, brushing, or hauling to safer places on the beach.
(Student answers will vary.)

Probably Being Hauled Away	**Things Being Brushed**	**Things Being Lifted**

Instructor Information. . .

"The Energy Crisis and Developing Nations"

Rationale: As more nations industrialize and the standard of living in these nations rises, the demand for energy also increases. To meet their energy needs, nations have increased the amount of energy, particularly oil, that they import. This increase in the price of oil created serious problems for both the developed and developing world.

Student Objectives: Students will be able to hypothesize about the possible long-range consequences of present trends in energy consumption.

Implementation: To get students interested in this lesson, you might have them set up a box or boxes of dominos so that when one is knocked down, all the rest will begin to fall. Ask them "How is this like the energy crisis? (Each country that uses oil is affected by the supply and price of the oil.) "What is another example of a resource we're using up very fast?" "How will that affect other countries?" Distribute "The Energy Crisis and Developing Nations" story. Read and then have students answer the questions.

Debriefing: Discuss student answers after they have had a chance to complete the questions. This story was published in 1977. Have any changes taken place in the situations of the developing countries and developed nations.

The Energy Crisis and Developing Nations
Page 1

Name _____

Date _____

energy sources growing scarce

trees—as a renewable resource

topsoil erosion

deep water drilling

developing nations depend on oil

oil price increases cause other price increases

In many ways the energy crisis has hit developing nations much harder than the industrial giants such as the United States and countries of Western Europe. For one thing, the traditional energy sources used in most developing nations — wood for heating and cooking, and open grasslands for animals — are growing scarce. These sources are getting harder to find and, therefore, more expensive.

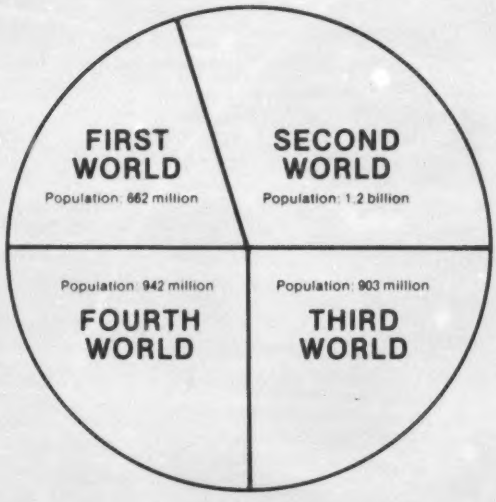
Trees, of course, are a renewable resource, but they can only grow so fast. Because the populations are growing all the time, more and more trees must be cut down to provide fuel. Younger trees with lower energy yields are cut down because they are needed for heating and cooking. When people are cold and hungry, there's no way to protect young trees.

Other things happen when you cut down most of the trees. Without trees for cover from the rain and the weather, the topsoil begins to wash away. Most of the nutrients are in the topsoil. New trees cannot take root very well without these nutrients. Rain will not soak into the subsoil quickly enough to renew the water table. Instead, most of the rainwater runs off into gullies and is lost. Consequently, water wells must be drilled deeper and the water pumped farther to reach the surface. These wells and pumps use a lot of energy and so the energy shortage gets even worse.

Firewood is not the only source of energy in short supply in the Third World. Until the 1973-74 oil embargo, many of the developing nations were starting to use more oil. Then, many developing nations discovered that their dependence on oil made them vulnerable.* By one estimate, the shortage of fuel for irrigation pumps in 1974 reduced the wheat harvest in India by one million tons.

The rising price of oil is having a severe effect on the developing nations that do not have oil. Certainly the cost of oil has risen everywhere. But for many of the developing countries this increase represents a large portion of their GNP. To make things more difficult, as the price of oil increases, the price of manufactured goods that these countries must import also increases. The industrial nations are charging more for manufactured goods to help cover the increased cost of oil. The price of the developing countries' exports, however, is not rising fast enough to balance out the higher price of the imported manufactured goods. The developing countries are paying more for imported goods and getting less for their exports. This imbalance is growing increasingly acute.

*Now they need oil to run their machinery, pump their wells, and irrigate their fields.



Who's Who

All the world, according to current diplomatic jargon, is divided into four parts: (1) the industrial democracies, mostly in the West; (2) the Communist states; (3) the developing nations, and (4) the worst economic hardship cases.

45

Name _____

Date _____

third world oil producing countries

tough decisions for oil rich countries

There are some countries in the Third World that produce oil. Countries such as Nigeria in West Africa and Venezuela in South America can use the profits from the sale of their oil to improve conditions in their countries. They are trying to develop other resources in their countries, too, so that when the oil runs out they will not be left with only the memory of their wealth.

Other Third World countries are hopeful that they will discover oil within their country. Some authorities believe that these areas may contain half of the world's remaining undiscovered oil. If oil is found, the developing nations will have to make some serious and difficult choices. For many, it might be more profitable to sell the oil at the present price of about $38* per barrel instead of using it in their own country. Then they could use the income tax from the sale of oil to develop renewable sources of energy such as a solar power which will last long after the oil supply has dried up.

In the meantime, the developing countries will continue to have a difficult time dealing with rising energy costs at home and around the world.

*OPEC price as of 2/82

Third World Countries

*Algeria
Angola
Argentina
Bahrain
Barbados
Bolivia
Botswana
Brazil
Cameroon
Chile
Colombia
Congo
Costa Rica
Cyprus
Dominican Rep.
*Ecuador
Egypt
El Salvador
Equatorial Guniea
Fiji
*Gabon
Ghana
Greece
Guatemala
Guniea-Bissau
Guyana
Honduras
*Indonesia
*Iran
*Iraq
Israel
Ivory Coast
Jamaica
Jordan
*Kuwait
Lebanon
Liberia
*Libya
Malaysia
Malta
Mauritius
Mexico
Morocco
Mozambique
Nicaragua
*Nigeria
Oman + Muscat
Panama
Papua New Guniea
Paraguay
Peru
Philippines
*Qatar
*Saudi Arabia
Senegal
Singapore
South Korea
Spain
Swaziland
Syria
Taiwan
Thailand
Trinidad and Tobago
Tunisia
Turkey
*United Arab Emirates
Uruguay
*Venezuela
Yugoslavia
Zambia
Zimbabwe

*OPEC MEMBER

Name _____

Date _____

Directions: After reading the story answer these questions.

1. What have been traditional sources of energy in developing nations?

_____

_____

_____

_____

2. Why are these traditional sources unable to meet the needs of the people?

_____

_____

_____

_____

3. How does erosion create a need for more energy?

_____

_____

_____

_____

Name _____

Date _____

4. What is the relation between energy shortage and reduction in farm products?

_____

_____

_____

_____

5. List two ways developing nations were hurt by the high oil prices.

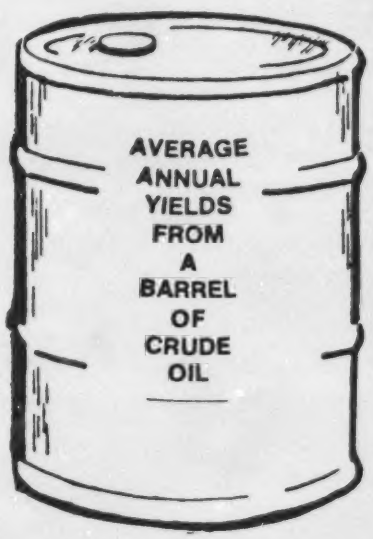
_____

_____

A Barrel of Crude Oil

Most Americans know that motor gasoline is refined from crude oil. Yet many are unaware that a barrel of crude oil contains 42 gallons, and that gasoline is only one of a number of products refined from it. In 1979, one barrel of crude oil typically yielded:

Product	Gallons	Percent of Yield
Gasoline	18.06	43.0
Jet Fuel	2.90	6.9
Ethane (including Ethylene)[1]	0.04	0.1
Liquefied Gases	0.97	2.3
Kerosene	0.55	1.3
Distillate Fuel Oil	9.03	21.5
Residual Fuel Oil	4.83	11.5
Petrochemical Feedstocks	1.97	4.7
Special Naphthas	0.25	0.6
Lubricants	0.55	1.3
Wax	0.04	0.1
Coke	1.09	2.6
Asphalt	1.30	3.1
Still Gas[2]	1.60	3.8
Miscellaneous	0.34	.8
Sub Total	43.52	103.6
Processing Gain[3]	-1.52	-3.6
Total	42.00	100.0



[1]Petrochemical feedstock (Ethane C_2H_6 and Ethylene C_2H_4)—used to make plastics and ethyl alcohol.

[2]Byproduct of the distillation process on the downstream side containing a variety of gases, normally methane, propane, and butane.

[3]The result of the addition of hydrogen during the refining process.

Instructor Information. . .

"Petrodollars: The Problem of too Much Money"

Rationale:

The United States continues to buy large amounts of oil from oil producing countries. The dollars spent on oil are then reinvested in world markets. Students will obtain a general understanding of "Petrodollars" and those countries which reinvest "Petrodollars" back into our economy.

Student Objectives:

Students will be able to define the term "Petrodollars."

Students will be able to gain an understanding of the OPEC Organization.

Implementation:

Distribute the story "Petrodollars: The Problem of Too Much Money." Have students read it and explain the chart showing the flow of money from oil-consuming nations to oil-producing nations and then back. Students can then answer the questions following the chart.

The two cartoon pages can be made into transparencies and can then be used to create discussion.

Debriefing:

Discuss the chart and any questions students have concerning the chart.

Petrodollars: The Problem of Too Much Money

Page 1

Name _____

Date _____

the value of products

Imagine having a product to sell that has a value of: the entire U.S. farm crop; all the steel produced in the United States for four and a half years; 10,000 fighter aircraft; 3,200,000 private homes; or all the cars and trucks produced in the U.S. for three and a half years.

oil producing countries (OPEC)

The members of the Organization of Petroleum Exporting Countries (OPEC) are in this unique position. OPEC is composed of the thirteen oil-producing nations of the Middle East, Africa, Central America, and South America who together control over half of the world's oil reserves. The sale of oil brings in more than $125 billion a year to OPEC nations. The cost of producing oil in the Middle East countries in particular, is low, and therefore much of this income is clear profit.

Controlling Oil Companies

oil companies used to control oil prices

This enormous wealth is new to most of the OPEC Nations. Until the 1960's, the large, multinational oil companies controlled the production and sale of oil. Because there was an abundance of oil and little competition, the multinational oil companies controlled the production and sale of oil. Because there was an abundance of oil and little competition, the multinational corporations were able to keep the price of oil low and reap a great profit.

OPEC controls the price

In 1960 the oil-producing nations decided they wanted to obtain more money from the sale of their oil. At first OPEC was successful only in keeping the price of oil from dropping. In 1973, however, Arab OPEC nations embargoed the sale of oil to some industrial nations. When the embargo was lifted, OPEC, convinced now of its power, raised the price of oil from $2 a barrel to $13 per barrel. Although there has been some internal disagreement about the wisdom of this high price, OPEC has managed to keep the price of oil high.

Surplus Money

how OPEC uses its money

With the increase in the price of oil, there has been a huge increase in the amount of money in OPEC nations. This income is being used to help OPEC nations develop. OPEC countries must import most of their manufactured goods, and some of their food. It is the profit they collect from the sale of their oil which pays for these goods. Many OPEC governments have directed the money to badly needed programs in housing, health care, education and industrialization.

buying weapons

For many Middle East OPEC members, a large part of their oil profit is used for defense. Weapons and armies are expensive, yet the situation in the Middle East has prompted the OPEC nations to buy planes and weapons. They purchase these from the industrialized countries such as the United States, West Germany and the Soviet Union.

Investments

investing in other nations

Even with developing programs underway and high defense spending, the OPEC countries still have enormous amounts of money. Increasingly, they invest this money in other nations around the world such as Great Britain and the United States. Among the companies partially owned by Arab and other OPEC nations are: Daimler Benz, manufacturers of Mercedes Benz automobiles; Arizona Land and Cattle Company of Phoenix; Kiaweh Island, South Carolina; Krupp Steel Works of West Germany; Security National Bank of San Jose, California.

petrodollar investments

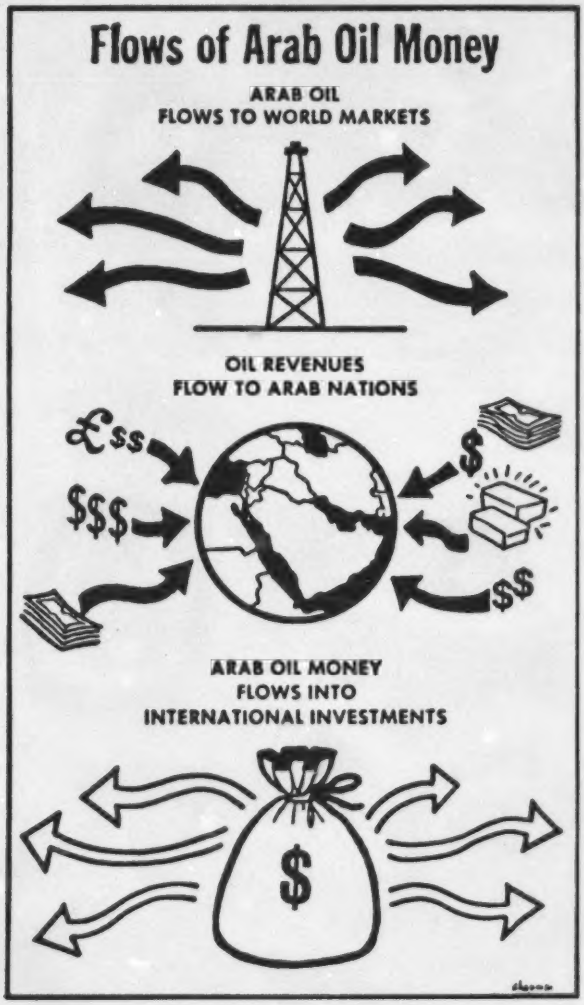
Money that the oil producing nations earn from the sale of oil and then reinvest in other nations is referred to as "Petrodollars." Some people are afraid that this investment in American industries by foreign nations is dangerous. It may give too much power to these foreign nations. Other people point out that the Petrodollar investments have helped to support American industry. These investments also mean that some of the money the United States spends on oil is brought back to the country.

Transparency

Instructor Information. . .

Petrodollars: The Problem of Too Many Dollars

The diagram below shows the flow of money from oil-consuming nations to oil-producing nations and then back to the oil-consuming nations. As you examine the chart, think of how it shows the concept of interdependence.



Petrodollars: The Problem of Too Much Money
Worksheet

Name _____

Date _____

Directions: After reading "Petrodollars: The Problem of Too Much Money," answer the following questions.

1. What are Petrodollars?

2. Why do OPEC nations have billions of Petrodollars?

3. Why are OPEC nations dependent on the sale of oil?

4. How have the OPEC nations used the Petrodollars within their countries?

5. Why are some economists worried about Petrodollars?

Instructor Information. . .

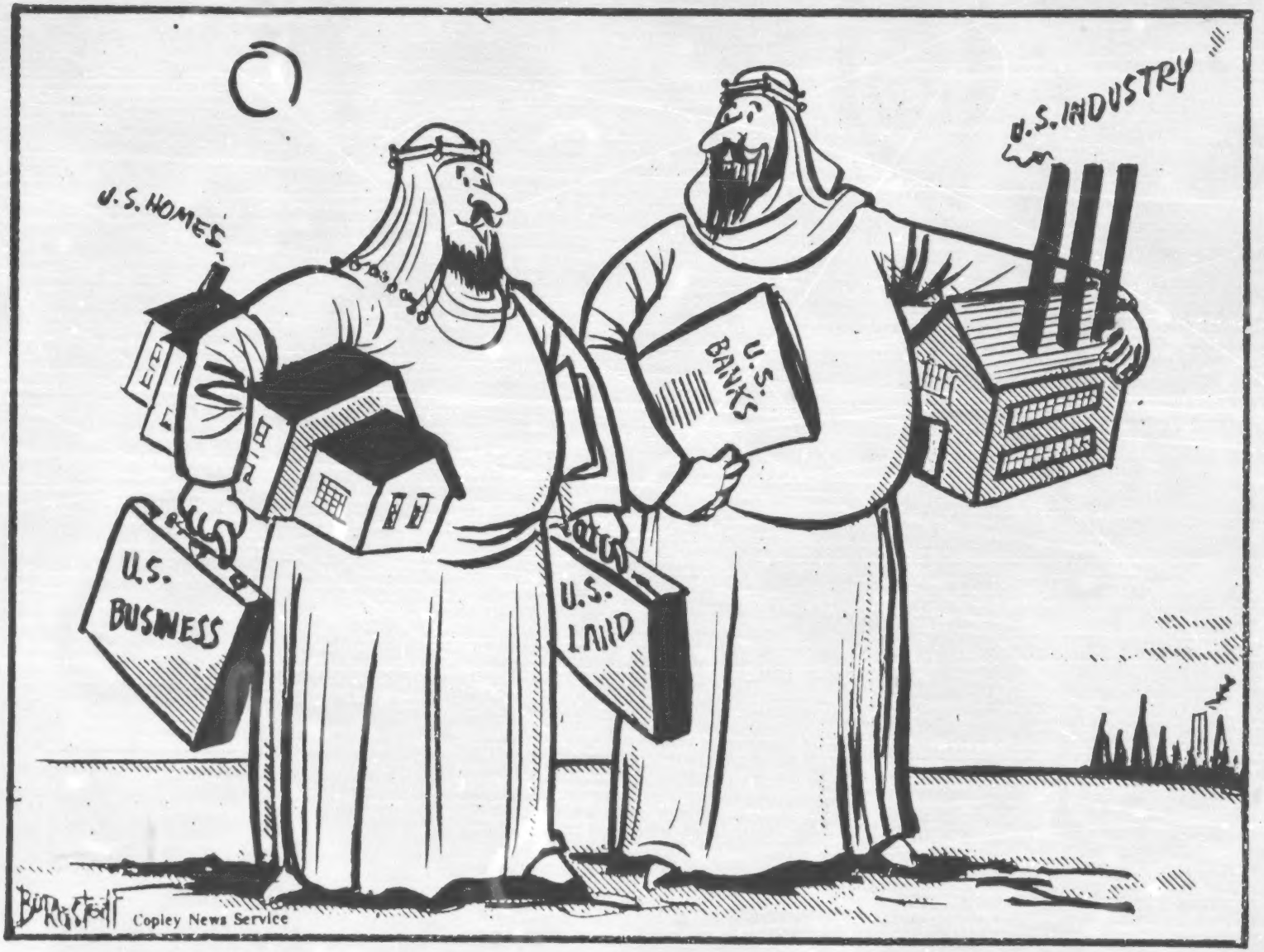
1. What are Petrodollars?
   (Money that the OPEC nations invest in other countries.)

2. Why do OPEC nations have billions of Petrodollars?
   (By forming a cartel, the OPEC nations were able to increase the price of oil while also increasing the quantity of oil sold.)

3. Why are OPEC nations dependent on the sale of oil?
   (These nations have few other natural resources. Without the income from the sale of oil they could not pay for the items that they need.)

4. How have the OPEC nations used the Petrodollars within their countries?
   (Roads, schools and resource development programs. Some of the money has gone for military expenses.)

5. Why are some economists worried about Petrodollars?
   (If the OPEC nations can buy control of some of the large corporations, they may gain economic and political power within the U.S.)



"We must do our bit to pep up the U.S. economy-!"

HEXON
NOW PLAYING
A WESTERN PUPPET PERFORMANCE
Thomas J. Mahoney

Instructor Information. . .

"Energy and Doubling Time"

Rationale:

There is little disagreement that the world's oil supply will eventually run out. There are many predictions as to when this will occur. These conflicting reports have at least made us aware of oil's dwindling importance in fulfilling our future energy needs. Students will be able to visualize this diminishing aspect of petroleum through the theory of doubling time or exponential growth.

Student Objectives:

Students will be able to read the story, "Energy and Doubling Time" and complete the charts.

Implementation:

Hand out the story "Energy and Doubling Time." Read through the story and as you come to those table graphs which are not finished, explain them to students and have them complete the charts. The "Questions Just For Fun" can be done as a class or individually.

Debriefing:

Although the readability on this story is 7.5, it may be necessary to review some vocabulary terms used throughout the story. The "Questions Just For Fun" can be discussed once students have read the story and attempted to complete the questions.

Name _____

Date _____

differing estimates

Conflicting Statements

Since the 1973 oil embargo, we have heard some "experts" say that there is an energy crisis while others say there is not. For example, in May of 1978, a World Bank official claimed that we have enough oil to last hundreds of years—at current consumption rates. Just one month later, President Carter's Chief Science Advisor made an estimate for the United States' oil reserves that was much closer to a 10-year remaining supply. These, of course, are vastly different estimates. Yet they are both made by important people. Who is right? Is there really an energy crisis that may change our way of life?

Recipe for Disaster: Finite Reserves and Doubling

history of energy in the U.S.

In order to better understand the problem, let's look at a graph showing the history of energy use in the United States. The amount of energy use increases toward the top of the graph while time moves from left to right.

As you can see, our use of energy has increased rapidly during this time and is still increasing.

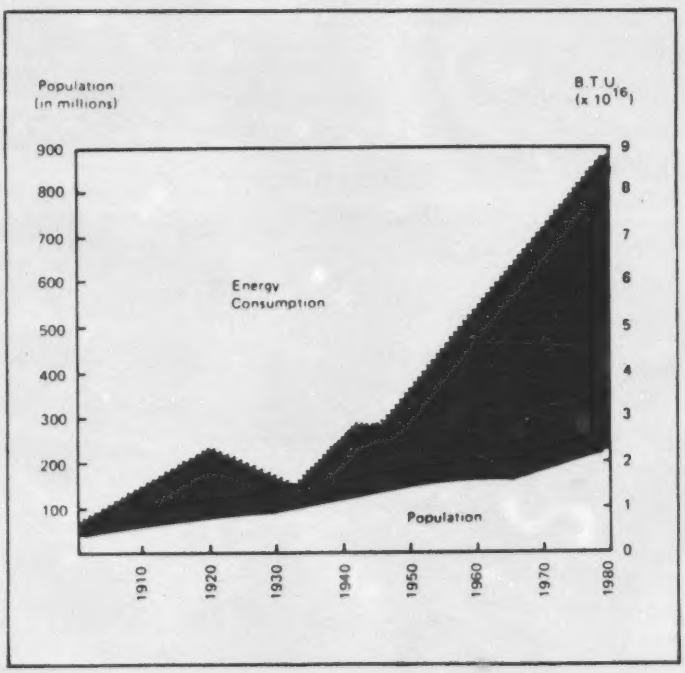


Figure 1. History of Energy Consumption in the United States

oil—a primary energy source

It's easy to explain our changing patterns of energy use. In earlier times, our energy needs were primarily confined to heating our homes and firing the cook stove. This energy was supplied by wood and coal. In fact, until 1950 coal was actually our most important fossil fuel. That was the first year in which we used more oil and natural gas than coal. During the first half of the 20th century, our way of life changed. We became an industrial, highly mobile, and throwaway society. Oil with its versatility has become our primary energy source.

our energy use

We have now reached a point where each of us, on the average, uses more energy than our parents and grandparents combined. In fact, the United States, with only 6% of the world's population, accounts for over 30% of the world's energy consumption.

Name _____

Date _____

change in lifestyle

limited energy sources

remaining supply of oil

doubling time

eating ortep

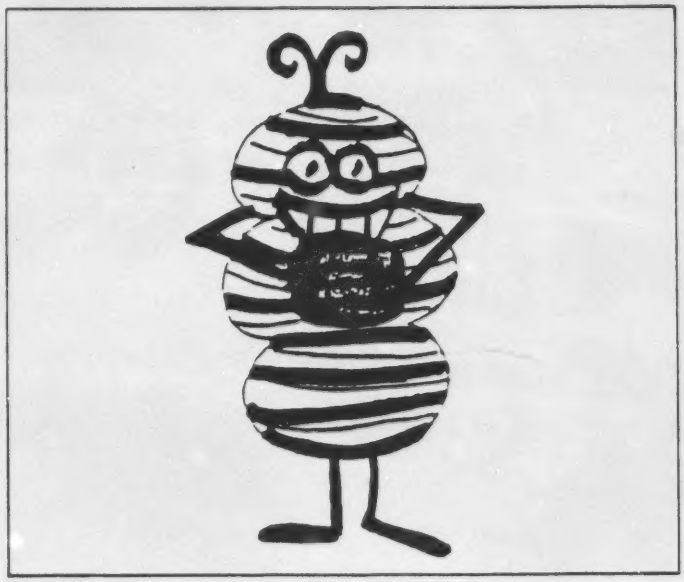
But there are distressing signs that the "sweet" ride is coming to an end—and that we will soon be forced to change our lifestyle whether we like it or not. In order to understand what the future holds, we must explore two important ideas.

First, we must understand the phenomenon of exponential growth, or doubling time. Second, because we are the most energy-hungry society on earth, we must also understand the effect doubling has on the use of limited energy sources such as oil and coal. Since oil is the main contributor to our energy needs, we will initially focus on our oil supplies.

The demand for oil is growing rapidly. Some say this means that we will soon run out of oil. Others point to estimates indicating that fully one-half of our entire original oil reserves are still in the ground. But that means that we have already used one-half of our reserves in 125 years. How long will the remaining one-half last? Doubling time holds the key.

The Ortep-Eating Snarf
Doubling Time

In order to explain doubling and its effect on a finite reserve, let me introduce the red-banded snarf.



Now, this ridiculous mythical beast reproduces very quickly. Under ideal conditions, a snarf can reproduce once every minute. In other words, the snarf's doubling time is one minute. Each and every minute, there are twice as many snarfs as there were the preceding minute.

Imagine that the snarf eats nothing but a rare material called ortep, which usually is quite hard to find. Now, suppose we were able to gather in one place all of the world's known reserves of ortep and place one snarf on this huge mountain of food at 11:00 a.m.

Name _____

Date _____

a growing need for food

Because the snarf reproduces every minute, at 11:01 there would be two snarfs munching happily away on a seemingly endless supply of ortep. They could truly last hundreds of years at their present consumption rate. However, at 11:02 four snarfs are on ortep mountain. Note that the number is doubling with each passing minute and their need for food doubles also.

At 11:03, we count eight snarfs happily eating ortep and so on. But at 12:00, we can't believe our eyes!

The number of red-banded snarfs has grown tremendously and they have completely exhausted their food supply. How could this happen in only one hour? Let me give you a clue—one hour contains 60 doubling times.

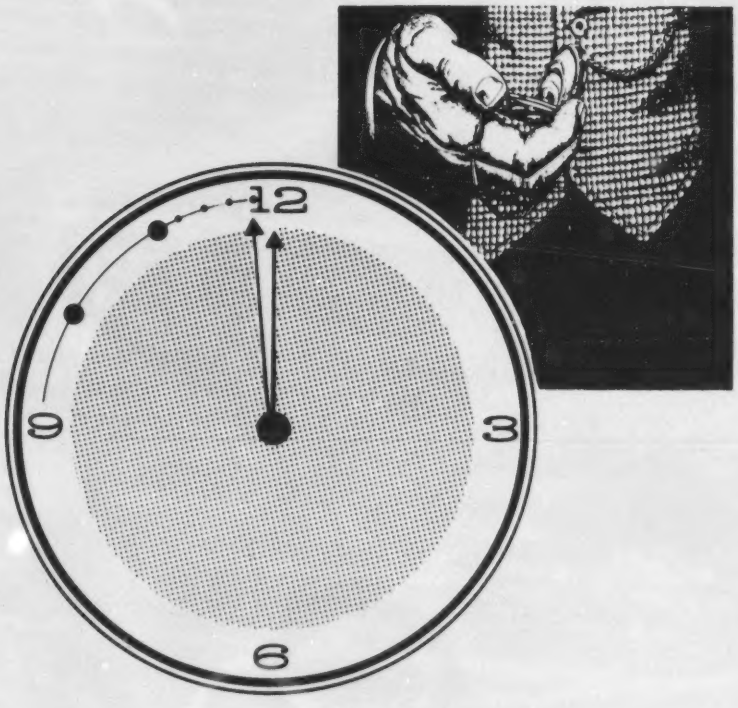
Now, consider two questions:

(1) When was the ortep half gone?

(2) When would the normal, average-IQ, red-banded snarf first notice the danger of running out of ortep?

signs of danger

Well, at 11:59, (one minute before noon) one-half of the entire mountain of ortep was gone—or put another way, one-half of the known world's supply of ortep still remained. But the number of red-banded snarfs was in the process of doubling again so that their need for ortep also doubled. In the next minute, by 12:00 noon, they used the remaining one-half of the world's supply of ortep.



Name _____

Date _____

Doubling Versus "Fantastic New Discoveries"

alerting neighbors

The answer to the second question is less clear. It's hard to tell when the average, reasonably alert, red-banded snarf would begin to worry. But let's imagine that they do something about their problem, and give the story a different ending. Let's look at the situation at 11:55. Maybe, at that time, one or two snarfs began to worry about the problem and tried to alert their neighbors—with no success. After all, at 11:55 only 3% of the ortep supply was gone, while 97% still remained. Who could possibly believe that there would be an ortep problem?

scounting for ortep

Finally, at 11:58, snarf leaders send out a team of very fast explorer-type snarfs to find more ortep. Now remember, the ortep is a non-renewable resource just like coal, oil, and natural gas. The only hope lies in finding previously unknown reserves.

Name _____

Date _____

new reserves

But joy is heaped on joy when, at 11:59, they return with good news. Fantastic new reserves of ortep have been found in Alaska and along the eastern shores of the United States. These new finds are equal to three times the entire previously known world's supply of ortep. How long will this new supply of ortep last?

a false hope

The picture is just as grim as it was before. The new ortep will again melt in the face of ever-increasing demands of a growing ortep-hungry population. By 12:01, the snarfs will consume one mountain of ortep, an amount equal to all that has been consumed in the previous hour. In the next minute, by 12:02, they will consume the next two mountains of ortep and will again be facing starvation. With these fantastic new finds the snarfs have only held on to the "good life" for a matter of two more minutes—two doubling periods.

Here, we must make a very important point: EVEN FANTASTIC NEW DISCOVERIES ARE USED UP QUICKLY WHEN DOUBLING TAKES PLACE.

Name _____

Date _____

Doubling and the History of a Resource

a re-examination of the problem

Let's look back again at the snarf's consumption of ortep and assume that each snarf consumes one bite of ortep per minute.

Table 1 shows that at 11:00 there was only one snarf who consumed one bite of ortep. At 11:01, there were two snarfs eating two bites per minute, but the total taken from ortep mountain was three. At 11:02, there were four snarfs gobbling four bites per minute and the total removed from ortep mountain was seven. It is very easy to continue this table for as long as you like. However, let's take a closer look at it.

reserves consumed rapidly

Between 11:01 and 11:02, there were four bites consumed, while in all previous history only three had been consumed. Between 11:02 and 11:03, eight bites were used, while only 7 had been used in all previous history. Between 11:03 and 11:04, sixteen bites were devoured, compared to the 15 consumed in all previous history. THE SECOND IMPORTANT POINT ABOUT DOUBLING IS: IN ANY ONE DOUBLING PERIOD, MORE RESERVES ARE CONSUMED THAN IN ALL PRECEDING HISTORY.

TABLE 1. Principal of Doubling Over Time

Time	No. of Snarfs	No. of Bites	Total No. of Bites
11:00	1	1	1
11:01	2	2	3
11:02	4	4	7
11:03	8	8	15
11:04	16	16	31
11:05			
11:06			
11:07			

Directions: Complete the chart. Fill in each blank.

Name _____

Date _____

From Ortep to Petro

oil equals ortep

The snarf's ortep problem is directly related to our energy crisis. Our demand for oil has been doubling just like the snarf's demand for ortep.

TABLE 2. United States Oil Use

Time	Doubling Time	No. of Barrels Used Per Year (in Billions)	No. of Barrels Used During Doubling Time (in Billions)	Total No. of Barrels Used (in Billions)
1923		.75		6.4
	17 yrs.		16.6	
1940		1.5		23.0
	14 yrs.		29.7	
1954		3.0		52.7
	18 yrs.		71.9	
1972		6.0		124.6
	??		??	
19??		12.0		

14-18 years doubling time

For example, Table 2 shows that during the year 1923, we used only 3/4 of one billion barrels of oil. Just 17 years later, our use doubled to 1 1/2 billion barrels. By 1972, we were using 6 billion barrels per year. Our oil doubling periods have been 14 to 18 years.

Name _____

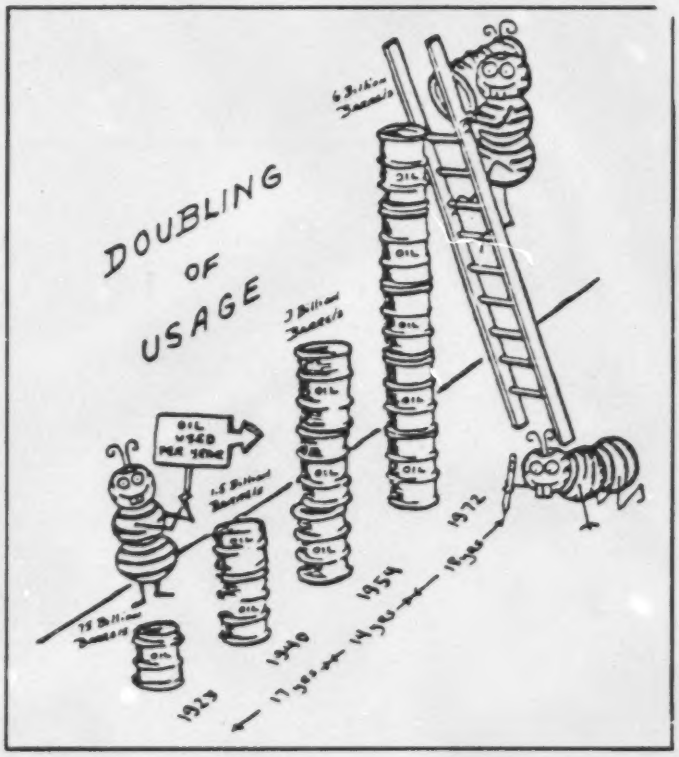
Date _____

demand is outstripping supply

production has passed its peak

Now let's look at the total amount of oil we have used. In all history prior to 1923, we had used approximately 6.4 billion barrels of oil. In the next doubling period from 1923 to 1940, we used 16.6 billion barrels—more than had been used in all previous history.

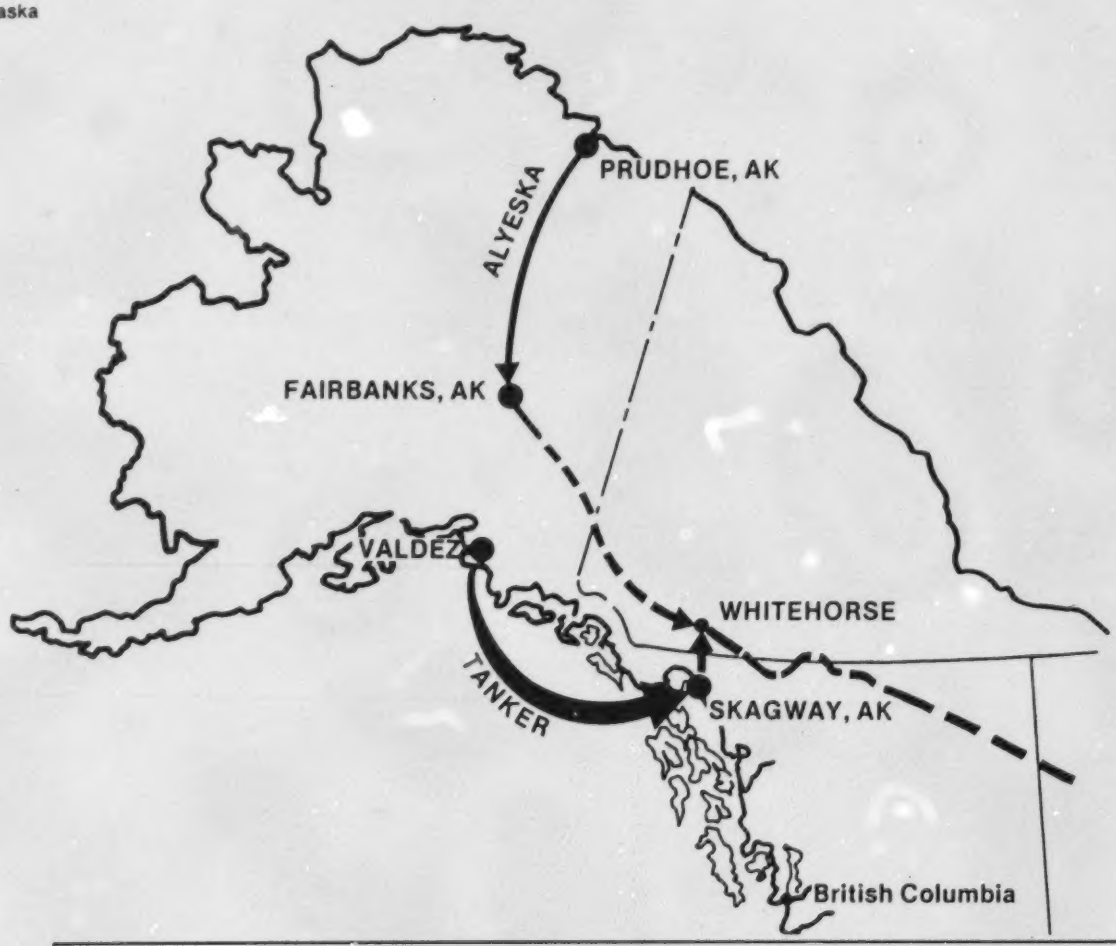
Our demand for oil has followed the same pattern of doubling as the snarf's use of ortep. In each doubling period, we used more oil than was used in all preceding history! We don't know how long the next doubling period will be. History shows it could be less than twenty years. What we do know, however, is that during that doubling period, we will use more oil than the 124.6 billion barrels that were used prior to 1972. But various estimates indicate that we have already used approximately one-half of our oil reserves. The time for our oil supply is clearly 11:59. Further, there is much reason to believe that U.S. oil production has passed its peak. We are now in a period of decline. Since 1970, we have been producing less each year while at the same time we have been using more. And, we must go further and drill deeper for new discoveries. Now it costs more and more to get the same amounts!



Name _____

Date _____

map of Alaska



temporary relief

The Alaskan, North Sea, and Gulf of Mexico deposits are impressive. They are greeted with great fanfare, as well they should be. But the very large Alaskan deposits, for example, **are equivalent to less than two years use at present U.S. consumption rates.** In order for U.S. oil to last one additional doubling period, (until 12:01) be it ten years or thirty years, we must find approximately twenty Alaskan-sized deposits. That is as much more oil as all of our known deposits, both past and present. But the declining production clearly makes this unlikely.

Name _____

Date _____

Will the Oil Run Out?

decline in oil's popularity

Are we really going to run out of oil? Probably not. It is likely that there will always be some oil pumped from the ground, but it will become very expensive and the competition for it will be so severe that it will no longer be the popular fuel that it is today.

coal as an energy source

Where then do we go for new energy sources? Coal has been extolled as our most abundant energy source—and indeed it is. It has been estimated that we have somewhere between 700 and 2800 years of coal in the United States at **present consumption rates.** Either estimate is sufficient to take care of our needs for many generations to come—if we don't continue to increase our consumption.

coal as a substitute

However, an 8% increase in coal production has been advocated to meet our increased energy needs and make up for shortfalls in the areas of domestic oil and natural gas production. When an 8% annual growth rate is considered, we have a doubling period of less than nine years for coal.

Let this block of 700 small cubes represent a 700-year coal supply if we use one small cube each year. But let's look at what happens if we double our use each 9 years.

doubling every 9 years

For ease in calculating, let's imagine that the growth is **not** gradual, but remains constant during each 9-year period and then doubles abruptly. Thus during the first nine years, we would use one cube each year for a total of 9 cubes. During the second nine years, our use each year would double and we would consume a total of eighteen cubes. Table 3 shows that the entire 700 cube block would be exhausted in less than 60 years. Remember that at our present rate of consumption it would have last 700 years! Actually, if we had computed this accurately using a gradual increase each year, we would have found that the supply would last only 50 years. For our purposes, however, the ease of calculation justifies the small error.

TABLE 3. Exhaustion of a Limited Resource Over Time With Doubling Principle Applied.

Years	Number of Cubes Used Per Year	Number of Cubes Used in 9 Year Doubling Period	Total Number of Cubes Removed from 700 Cube Block
1-9	1	9	9
10-18	2	18	27
19-27	4	36	63
28-36	8	72	135
36-45	16	144	279
46-54	32	288	567
55-63	64	576	1143

Name _____

Date _____

Questions Just For Fun

1. How long will the 2800-year supply last?

2. How long would either supply last with a growth rate of only 4% (doubling time of 17.5 years) or 2% (doubling time of 35 years)?

Name _____

Date _____

limited fossil fuels

using fuels faster

the need to act now

the time-line grows shorter

Now let me summarize four important ideas.

First—Our energy use has been, and still is, following the rules of doubling time—just like the snarf and its use of ortep.

Second—95% of our energy comes from fossil fuels—oil, coal, and natural gas. **These supplies are limited and non—renewable.**

Third—In each doubling period we will use more of these fuels than has been used in all preceding history.

Fourth—Even very large new discoveries will be devoured in unbelievably short time periods.

The situation may sound hopeless. However, it's hopeless only if we fail to act now. We must reduce our use of energy in every way possible. But at the same time, we can look with hope to the many alternative energy sources that may supply our future energy needs such as nuclear, solar, hydrogen fusion, and wind power. While there are major problems with each of them, we should not become discouraged. We must make every effort to develop all reasonable alternatives.

In the meantime, reduction in energy use is extremely important because it will help buy the time needed to develop other energy sources. If we continue to increase our energy use, the time-line for development of alternative sources is very short.

Name _____

Date _____

holding our energy growth

Remember, Table 1 showed that our growth in energy use has been much greater than our growth in population. Since 1940, our population has **doubled** while our use of oil has **quadrupled**. We obviously cannot continue that kind of growth rate. Holding our energy growth to the same rate as our population would indeed, help us, but we did not start soon enough. If we had started to conserve in 1940, and increased our energy use only as our population grew, we would now be using approximately 3 billion barrels of oil per year instead of nearly 7! We would, even now, be energy self-sufficient and have the time needed to adequately develop alternative energy sources.

slowing population growth gives us some time

We must now, therefore, actually **reduce** our present levels of consumption per person and then maintain it such that our total energy use grows only as our population grows. Many things are in our favor. We already enjoy an energy-abundant way of life. Modest conservation measures will hardly reduce our standard of living. Further, the United States population growth has recently slowed to a doubling period of approximately 90 years. Therefore, if our energy grows only with our population, the next doubling period for energy use would also be 90 years rather than the expected 20 years. This extended doubling period together with actual reductions in our use of energy, will buy the time we need to help us maintain a high quality of life.

POPULATION GROWTH?

ENERGY CONSUMPTION?

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Name _____

Date _____

it's up to us

The problem is serious but not hopeless. It is hopeless only if each of us fails to act now.

What can **you** do to reduce energy use? Perhaps a more important question is, what **will** you do to reduce energy use?

Energy Inventory

Assignment for Today

1. Do I Save Energy? OR
2. Do I Waste Energy?

ENERGY CONSERVATION!

THE CHOICE IS YOURS!

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Instructor Information. . .

"The Oil Price Game—Everybody Plays"

Rationale:

This activity presents trade dilemmas for members in a competitive market and in a controlled market. Using the example of the world market for oil, students examine the effects of competition and non-competitive cartel prices.

Student Objectives:

Students should be able to: describe the effects that different market conditions have on prices; and identify the forces which work to strengthen or to weaken world market agreements.

Materials:

32 SELL cards
32 BUY cards
2 different colored sets of armbands (enough for the entire class).

Implementation:

Divide the class into two groups. Distribute one set of cards to the Oil Consuming nations; a different set of cards to the Oil Producing nations. Tie one color of armbands on the Oil Producers and use another color tie for the Oil Consumers.

Allow plenty of time for students to get a notion of the game and learn the procedure.

Anticipate some difficulty with learning how transactions are made and prices reported.

Play begins with the distribution of BUY and SELL cards. (It will help speed up the game if you match the color of the card to the armband color.) The 32 BUY cards should be worded:

BUY

Buy 1,000 barrels of oil for **not more than $**_____ per barrel. Try to get the best price you can below this price. **Do not** buy oil above this price. If you haven't bought any oil after 5 minutes, get another buy order.

Insert price per barrel on each BUY card according to this distribution.

Price	Number of Cards
$21.00	4
$19.00	4
$17.00	4
$15.00	4
$13.00	4
$11.00	4
$ 9.00	2
$ 7.00	2
$ 5.00	2
$ 3.00	2

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SELL

Sell 1,000 barrels of oil for **not less than $**_____ per barrel. Try to get the best price you can above this price. **Do not** sell oil below this price. If you haven't sold any oil after 5 minutes, get another sell order.

Insert price per barrel on each SELL card according to this distribution.

Price	Number of Cards
$19.00	2
$17.00	2
$15.00	2
$13.00	2
$11.00	4
$ 9.00	4
$ 7.00	6
$ 5.00	6
$ 3.00	4

A complete set of Buyer and Seller cards should be used whenever the game is played with a class of more than 32 students. While the game is played, the cards should be kept in separate stacks on a desk near where the recorder is tallying the prices. As cards are turned in, students should take a different buy or sell order, according to their roles. Individual cards may be used more than once in the game, but make sure students don't keep cards for more than **one** transaction. If a student is unable to complete a transaction within five minutes, a new card may be given out to replace the old instructions.

Record the price on the board where students can see the price at which oil is being sold. One way to show the tendency of prices to reach some "equilibrium" level is to record prices by time period. The following table could be used to record this information on the board.

Activity #8
Continued

Instructor Information. . .

Price	Five Minutes of Play	Second Five Minutes of Play	Third Five Minutes of Play
$ 21			
20			
19			
18			
17			
16			
15			
14			
13			
12			
11			
10			
9			
8			
7			
6			
5			
4			
3			

Prices in the left column list the **possible** prices at which oil could be sold in the game. As students report each transaction, make a mark beside the price reported. Separate transactions made during the first five minutes from those in other time frames. Transactions tend to move toward the equilibrium as time passes, mainly because more buyers and sellers become aware of the price of oil.

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Debrief:

After fifteen minutes, or sooner if the price has stabilized, declare the market closed, collect all outstanding cards, and ask the students to analyze what happened. Deal with the following questions:

1. Economists often talk about the supply and demand for a certain product. **Who demanded oil in the game?** (The Buyers; the Oil Consuming nations.)

2. **Who were the suppliers?** (The Sellers; the Oil Producing nations.)

3. **At the beginning of the game, what was the range, the highest and the lowest prices, at which oil sold? Was the price range as wide during the succeeding five-minute periods? Why or why not?** (Most simulations start off with the maximum range, from $3 to $21, with transactions moving toward the theoretical equilibrium of $11, by the end of the game. Don't expect $11 as the only price at the game's end. Price will nearly always vary, but with each round the variance will decrease.)

4. **By the end of the game, what price do you think would have been acceptable to the majority of Buyers and Sellers? Why?** (Answers will vary. Usually students will see that a price becomes acceptable when it is not violating the majority of Buyers and Sellers instructions, and when it still allows some profit to both parties.)

5. **What happened when a seller tries to sell at a price higher than the acceptable price? Did the same thing happen when a buyer tried to buy at a price lower than the acceptable one?** (Students should suggest that the price above or below this acceptable price would be impossible for most participants to meet.)

6. **How does the market for oil differ from the real world market?** (Most of the oil sold in the world market is controlled by OPEC. This organization of petroleum exporting nations determines the supply and price of oil. There is no competitive market for the international sale of oil.)

Special Note:

The student worksheet for this part of the simulation develops in greater depth concepts of equilibrium prices, and supply and demand.

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The Oil Price Game
Part II

The first part of the simulation created a world market for oil, but it was unlike the present real market because it contained competition among both buyers and sellers. Today the world market for oil is dominated by a single selling cartel—OPEC.

To simulate a cartel, tell Sellers that they must agree upon a price before beginning any bargaining. They must **not** change this price during the bargaining session.

Allow enough time for oil producers to determine the oil price. After the "cartel" has decided on a price, distribute BUY cards to the rest of the class. These students should be instructed to buy oil at the lowest price possible, and yet not violate their instructions. Record the transactions as before. You should anticipate two outcomes:

1. Students in the "cartel" will stay with their fixed price thus making it impossible for some buyers to purchase oil. Frustration will bring the game to an end quickly with only a few students being able to make a transaction.

2. Sometimes "cartel" members will be unable to maintain their fixed prices, because of pressure imposed by the frustrated buyers. If this happens, keep the game going until the fixed price is either re-established, or dissolves entirely.

Debrief:

At the end of the simulation have students review what happened. Use the following questions to help guide the thinking:

a. **How was the price of oil determined in this game?** (The cartel members agreed beforehand on the price. They tried to maintain this price despite pressure from their buyers.)

b. **How did the outcome differ from the first one?** (Probable answers: difference in final price; cartel produced a higher price.)

c. **Why might some cartel members break a price agreement?** (Some nations might think they could make more money by selling more oil at a lower price. Pressure from buyers, and distrust of other cartel members also might influence decisions.)

d. **What factors help a cartel maintain a fixed price?** (A cartel is most likely to be sucessful if the members have similar political or ideological ties.)

e. **Of the two types of world oil markets, which is better for consuming nations? Why?** (The competitive market. In an open market prices are lower and quantity produced is greater than in a controlled market.)

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f. **Which is probably better for producing nations—the cartel or competitive market?** (Probably the cartel, since the profits are generally greater.)

g. **How can a rise in world oil prices affect production of oil in the United States?** (A higher world price might make it profitable to develop new oil wells or seek alternative sources of energy. These activities would increase production of energy in the United States.)

h. **What might happen if the price of oil quadrupled?** (Perhaps world-wide economic depressions. This, of course, could reduce the demand for oil to a point where oil prices might drop again.)

Concluding the Lesson

Conclude the lessons by reviewing some of the complex forces that bear on the pricing of commodities in world marketplaces. Encourage further research into the effect of higher prices of oil on people and the way they live. Assign students to do the following research activity.

For Further Research

Research one aspect of high energy prices. Choose one of the following areas: (a) residential and commercial buildings; (b) agriculture; (c) transportation; (d) leisure time activities; (e) industrial production; (f) new fuels and search for new sources of energy (or a return to old fuels). Use the following questions as a guide to your research.

1. Throughout most of our history, what energy policy have Americans followed with regard to _____? (Name your specific area.) Has that policy contributed to any present problems in this area? List them.

2. What other problems does the nation face in this area today?

3. Are there current programs or projects intended to deal with these problems? Is the government sponsoring or encouraging any of these programs, such as conserving energy in these areas? Have they been effective so far? Why or why not? What are some private business programs? Are they effective?

4. Which solutions do you favor? Why?

5. What sacrifices will be needed to overcome high energy use (and resultant customer cost) in the area you are investigating? Do you think people will be willing to make the necessary sacrifices?

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BUY

BUY 1,000 BARRELS OF OIL FOR **NOT MORE THAN** $_____ PER BARREL.
TRY TO GET THE BEST PRICE YOU CAN BELOW THIS PRICE. DO NOT BUY OIL ABOVE THIS PRICE. IF YOU HAVEN'T BOUGHT ANY OIL AFTER 5 MINUTES, GET ANOTHER BUY ORDER.

SELL

SELL 1,000 BARRELS OF OIL FOR **NOT LESS THAN** $_____ PER BARREL.
TRY TO GET THE BEST PRICE YOU CAN ABOVE THIS PRICE. DO NOT SELL OIL BELOW THIS PRICE. IF YOU HAVEN'T SOLD ANY OIL AFTER 5 MINUTES, GET ANOTHER SELL ORDER.

SUPPLEMENT

Pamphlet

Energy Info—A Directory of Publications and Audiovisual Materials From the Nebraska Energy Office.

Audio-Visuals

¾" Color Video Cassettes (These are listed in the above pamphlet.)

Forgotten Fundamentals of the Energy Crisis (54 minutes). Dr. Albert Bartlett presents a provocative view of the energy situation in terms of exponential growth. (High School level).

Run With the Sun (58 minutes). An overview of solar applications in Nebraska.

Oil: Crisis Or Catharsis (30 minutes). A look at Nebraska's petroleum problems.

The Energy Store A five-part series, showing students in grades 6-10 how they can cut their energy use. (Accompanying teacher's guide.)

Paper

"Energy for Development Third World Options," World Watch Paper, December, 1977.

Simulation*

The original "Oil-fuel of the Past," unit contained a map activity simulation. This simulation directs students to identify supply and demand of oil. The activity has also been designed using "WANG" BASIC and may have to be modified for other machines. This is available from the Nebraska Energy Office. Use the ordering page to obtain this activity.

SUPPLEMENT

Books

1. THE U.S. FACT BOOK: Bureau of The Census and Department of Commerce, Bookstore, $3.95.

2. ENERGY; Carrol L. Wilson, Project Director of the WAES Report, Bookstore, $6.95.

3. EXPLORING ENERGY CHOICES; S. David Freeman, Project Director, Ford Foundation Energy Policy Project, Bookstore, ESU #2.

4. PLANT AT A CROSSROADS; Robert Dwyer, Millikin Publishing Co., St. Louis, MO, $7.95. (A book with some overhead transparencies and duplicating masters), ESU #2.

5. ENERGY AND ECOLOGY; Youth Foundation, 10 E. 40th Street, N.Y., N.Y., 10016, $6.95. (A book of transparencies with diagrams of how things work, news clippings, games), ESU #2.

6. ENERGY CRISIS; Wendell Curry, Project Coordinator, State Department of Education, 942 Lancaster Drive NE, Salem, OR 97310 (A set of Activities).

7. ENERGY, ENVIRONMENT, AND EDUCATION; The Energy Conservation Foundation, 1717 Mass. Ave., N.W., Washington, D.C. 20036 (A book with issues and answers in 1973).

8. EASY ENERGY READER, Book II; "History of Energy," U.S. Dept. of Energy, Technical Information Center, P.O. Box 62, Oak Ridge, Tennessee 37830.

Other

American Petroleum Institute
1801 K St., N.W.
Washington, D.C. 20006

American Oil Co.
Karl Prohl, Supervisor
Youth and Educational Activities
910 Michigan Avenue
Chicago, IL 60680

Exxon Company U.S.A.
Public Affairs Department
P.O. Box 2180
Houston, TX 77001

Shell Film Co. Library
450 North Meridian Street
Indianapolis, IN 46204

Standard Oil Co. of California
Public Relations Department
225 Bush Street
San Francisco, CA 94120

Energy Information Request Form

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Oil! Fuel of the Past

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